COMPRESSED AIR MAGAZINE

DEVOTED TO THE USEFUL APPLICATIONS OF COMPRESSED AIR

Vol. xxiii FEBRUARY, 1918 No. 2

OVER 15,000 COPIES THIS ISSUE

Published by THE COMPRESSED AIR MAGAZINE CO., Easton, Pa.

NEW YORK, Bowling Green Building LONDON, 165 Queen Victoria Street

Classified Buyers' Guide, Page 14. Index to Advertisers, Page 11.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Vol. xxiii FEBRUARY, 1918 No. 2

COMPRESSED AIR FOR FORGE SHOPS

BY CHARLES A. HIRSCHBERG.

The modern manufacturing plant and many remodeled older ones are resorting to electric current, direct motor drive, in place of steam engine and line shaft, because of its greater convenience, cheaper maintenance, generally neat and cleanly appearance and the many economies it makes possible in the operation of the private power plant. In some cases where a serving company is available the power plant with its boiler equipment and coal pile have disappeared entirely.

The forge shop can be electrified to as great advantage as the balance of the manufacturing plant. A few establishments, caring nothing for precedent, have explored its possibilities, and in these explorations have discovered that it remained but to employ the proper means of transmission to make the innovation a complete success. Compressed air, so often a companion of electricity and like it a power transmitting agency—not a prime mover—has been called upon to supply what might be termed the connecting link between the electric motor and the hammer.

In reality such a plant may be termed an electro-pneumatic power forging plant. The equipment consists of an electric-motor-driven air compressor supplying compressed air instead of steam to the forging hammer. This equipment is usually installed in an out-of-the-way corner of the forge shop. It requires no constant supervision and has many other advantages; and the following discussion and typical examples are for the purpose of acquainting the forge shop with the practice and to place at its disposal the experience of those who have pioneered.

At the start it may be well to say that there are no mysteries connected with compressed air. It is often misunderstood because it is given only passing investigation. It is easier to deal with than steam and compares favorably in cost with other forms of power and, under certain conditions, such as those treated on in this article, the advantage is decidedly on its side.

For our purpose we will classify the general

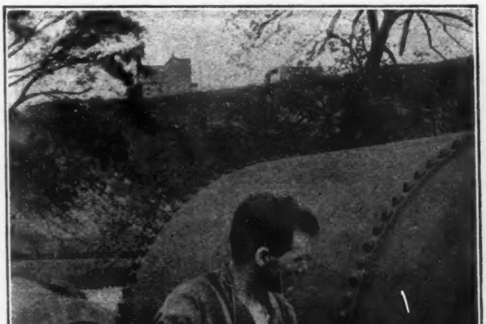


FIG. I

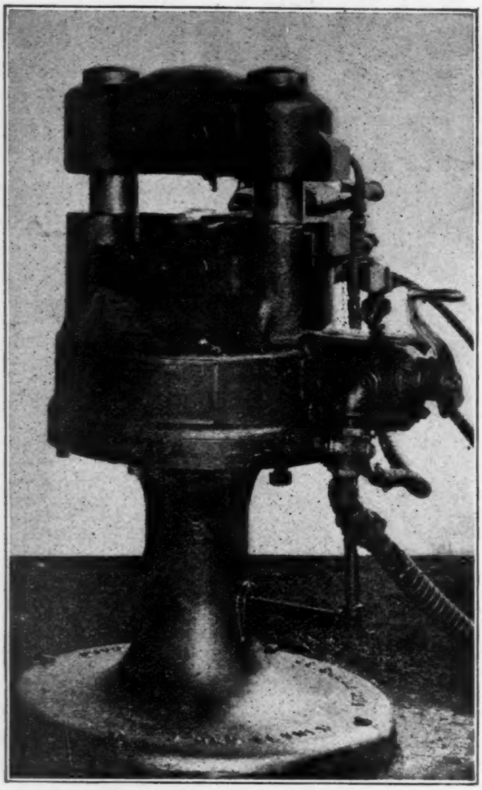


FIG. 2

subject of forging into several groups, as follows: Upsetting, bending, forming, pressing, forging.

UPSETTING.

Perhaps the most common example of this class of work (entirely overlooked because we have learned to distinguish it by some other name) is that of forming heads on rivets by means of hand-held pneumatic riveters, yoke riveters, etc., as illustrated by Fig. 1.

This work bears the ear marks of many forge shop operations; for instance, upsetting bolt heads, heading pins and forming collars. Which brings to mind the fact that the coal and metal mines have long employed a type of pneumatic forging hammer, commonly called a drill sharpener, see Fig. 2, for upsetting various forms of shanks on drill steel, also drill bits, as well as pins, bolts, pipe hangers, etc. In Fig. 3 is shown a set of dies for forging bolt heads and sample of stock and finished work.

In fact, an appreciation of the meaning of this service has not infrequently caused the mine blacksmith to appropriate a discarded reciprocating rock drill, installing it, as shown in Fig. 4, for many odd jobs of forging. The drill minus the shell is fastened to a column or vertical support and an ordinary anvil fixed in position beneath the ram. The power connection consists of an air hose, coupled from the air line to the usual inlet of the drill. Fig. 5 is interesting in that it shows the mine drill sharpener applied to nosing shrapnel..

Lately shipyards are adopting them for upsetting heads on long bolts or rods of which so many are used in wooden ship construction. They are particularly adapted for this work, because the principle of forging or upsetting is such as to make the length of rod immaterial.

UPSETTING, BENDING, FORMING.

Railroad shops have been quick to recognize the advantages of compressed air applied to many operations of upsetting, bending and forming, and, as a result, have developed a number of machines for upsetting heads on bolts and king pins, for forming hooks and eyes, pipe clamps, angle straps, etc..

In Fig. 6 is shown one such 70-ton machine and termed by the railroads a "bulldozer." Its employment has a marked effect in the reduction of the cost of many special forgings, increased output as well as in an improvement in the quality of work.

Referring to Fig. 6, the machine, a railroad shop bulldozer, consists of two 30-inch cylinders which are attached to a frame made up of two 16-inch I beams, with the face plate attached at their top. The cylinders were placed tandem, enabling the concentration of the full power of both cylinders at one point. The arrangement is also such that one cylinder may be used independently of the other on light work. A working pressure of 70 pounds per square inch is employed.

BULLDOZER RECORDS.

Pipe clamps of various sizes are formed in

FIG. 3

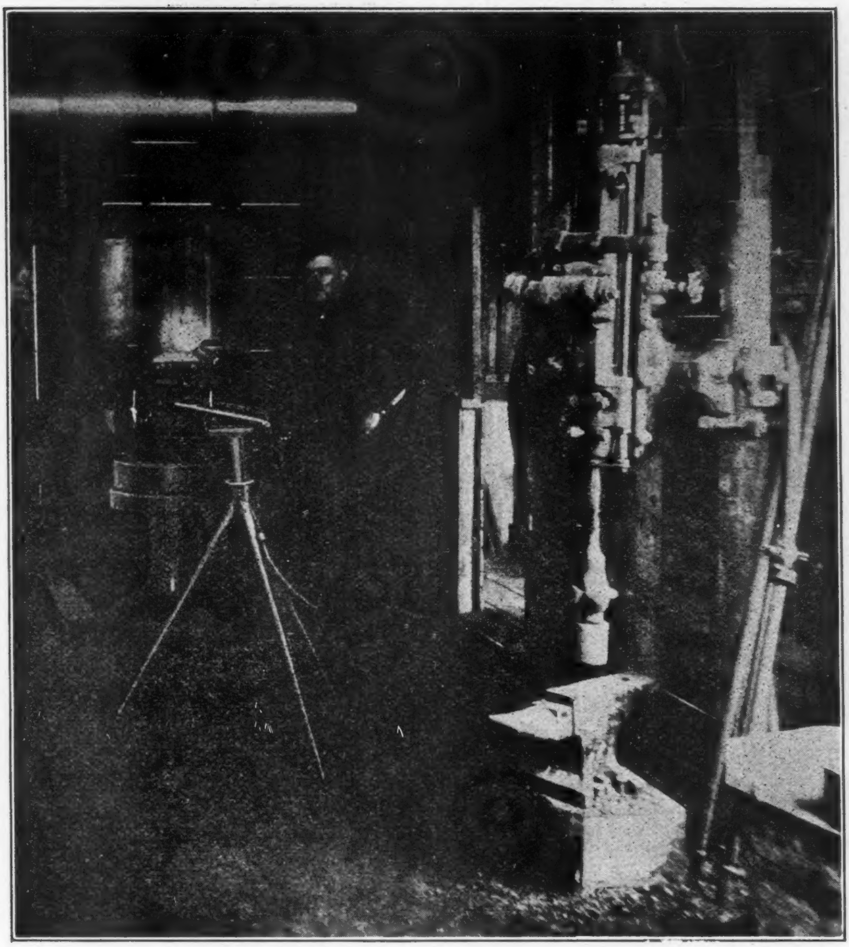


FIG. 4

one minute each. Locomotive main rod straps, weighing 236 pounds, have been forged in 47 seconds. Valve yoke forged complete in 5 minutes. Turnbuckles forged and welded in two operations, smoke arc braces in one blow. From one to three minutes is required for changing dies. In most cases the actual changing of dies and the forging operation is done in less time than that required for heating.

This machine, first installed experimentally, proved such a great success that its manufacture in standard sizes was undertaken by a Chicago manufacturer.

In Fig. 7 is shown a portable machine designed for bending pipe. The dies are changeable, making it possible to handle an almost unlimited variety of shapes. Any size of pipe up to 2½ inches can be worked cold without filling. It does not flatten or split the pipe. Tests show that this machine will put a 90 degree angle in a 2-inch pipe in two minutes. It operates on an air pressure of 80 to 100 pounds. While sold for pipe bending, it may also be applied to the bending of various shapes of bar iron, angles, etc.

The above machines are strictly pneumatic. They have been illustrated and described chiefly to prove that pneumatic forging is not an experiment.

AIR SUPERSEDING STEAM.

In reading the following cases it will be evident that accident played an important part in the conversion from steam to compressed air operation, and yet the dominant note was the need for electrifying the forge shop so as to conform with the balance of the plant practice.

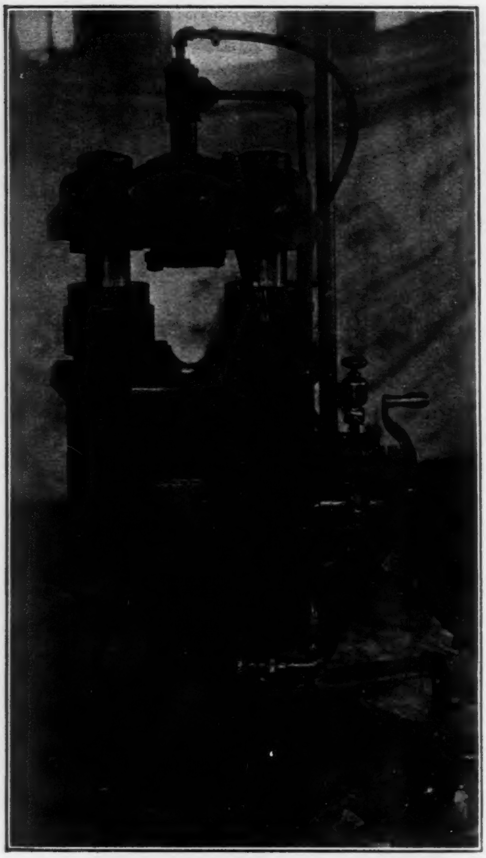


FIG. 5

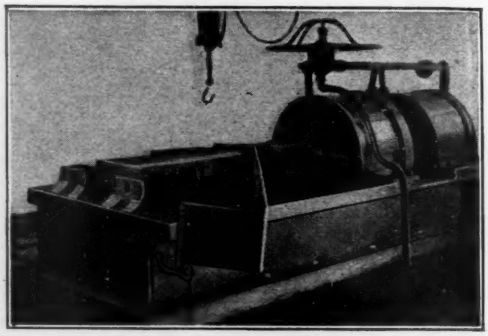


FIG. 6

The Buffalo-Pitts Company, of Buffalo, N. Y., was one of the first to demonstrate the advantages of air operation for forging hammers. They made the change primarily because of the fact that the rest of the plant was operating on electric current. It was desirable to electrify the one big steam hammer for the operation of which a battery of high pressure steam boilers were being run. A motor driven compressor was installed not only to operate this hammer, but many other pneumatic devices.

Another pioneer in this direction is the Nisqually-Russel Car & Locomotive Works, of Tacoma, Wash. About five years ago (1912) the city boiler inspector condemned the boiler in this plant. It was chiefly used to furnish steam for the large hammer. Instead of buying a new boiler, the old one was converted into a vertical air receiver and a belted-to-motor compressor installed to furnish power to the hammer.

It is stated that $50.00 a month is a liberal estimate for the power consumption of the compressor, whereas the fixed charges under the old system were $62.50 per month for the licensed fireman at $2.50 per day, and $31.25 for 12½ tons of coal at $2.50 per ton, making a total of $93.75 or a saving in favor of air operation of $43.75 a month.

In addition the air is used for operating other tools, therefore the saving is in reality greater than the figures show. On the above basis, however, the saving per year in this plant is $525. This company further stated that aside from the saving there is a decided advantage in the increased efficiency of the hammer, as they were only able to carry 90 pounds pressure on the boiler and they figured this gave them about 60 pounds working pressure at the hammer. The air, on the other hand, is practically at the same pressure at the hammer as in the receiver, and they got fully 90 pounds on the piston. It is further stated

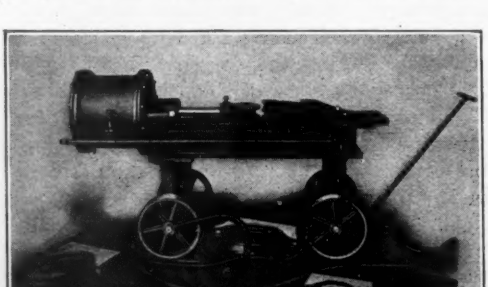


FIG. 7

FIG. 8

that "the air is quicker, and although not quite so elastic as the steam (?), is nevertheless very satisfactory."

Another example is related by the Franklin Institute "Journal," as follows:

"The Cumberland County Power & Light Co., of Portland, Me., has recently been successful in the conversion of steam-hammer equipment to electro-pneumatic service, a pioneer installation being made at the plant of the Marine Hardware & Equipment Co. At this plant a 1,200-pound Bement-Niles steam hammer was in service, steam at about 90 pounds per square inch being required for many hours daily. To avoid condensation troubles, it was necessary to run the hammer practically continuously. As eleceric-motor drive had been adopted for other purposes throughout the plant, it was found possible to do away with the demand for continuous high-pressure steam by adapting the steam hammer to air operation and installing a motor-driven compressor to supply air for this purpose and other requirements. The valve of the steam hammer was rebuilt for a fit of 0.0025 inch compared with a previous fit of 0.005 inch under steam service. The hardware company purchased a 50-hp. 220-volt, three-phase, Westinghouse squirrel-cage induction motor designed for 900 revolutions per minute, and belted it to a 12-inch and 7-inch by 12-inch compressor delivering air at 90 pounds to the storage tank supplying the compressor. A branch exhaust terminating in two ½-inch pipes was led down the frame of the hammer to outlets directed upon the working anvil surface, so that all chips and scale are immediately blown away in operation. It was found that harder and quicker blows could be struck

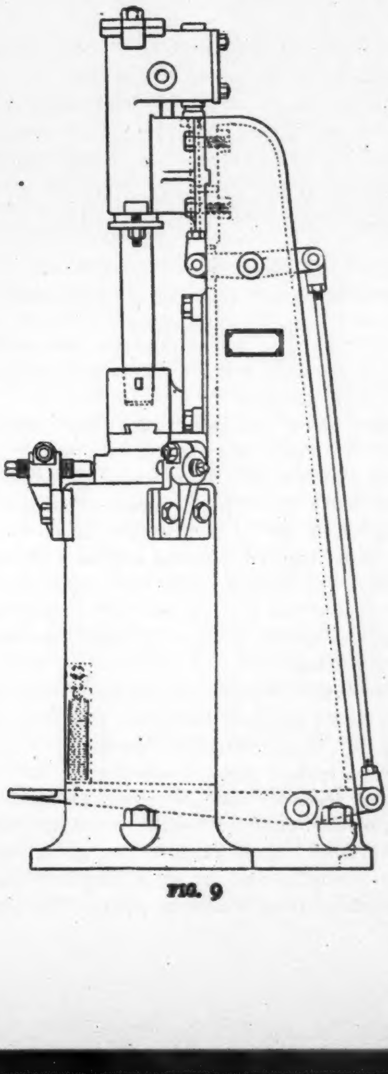


FIG. 9

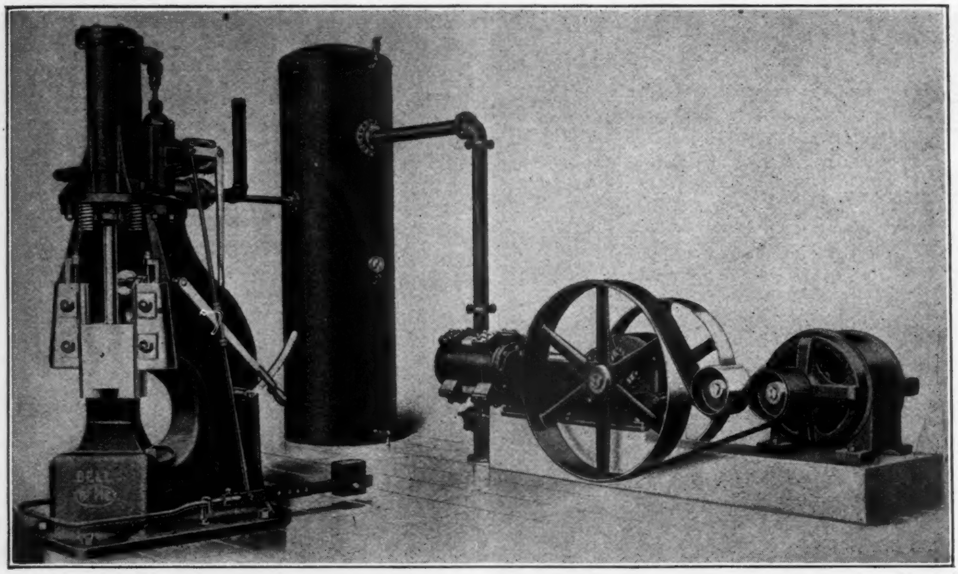


FIG. 10

than under steam conditions." The hammer installation is shown in Fig. 8.

Manufacturers of forging hammers have begun to realize the importance of meeting this demand for an electrified forge shop and have recently developed machines especially adopted for pneumatic operation.

In Fig. 9 is shown a pneumatic drop press designed for stamping sheet metal hot. Sizes range up to 46x72 inches, face of hammer. The power consumption ranges from 60 cubic feet of free air per minute for the smallest size, to 200 cubic feet for the largest at a pressure of 90 pounds.

Other drop hammers have been designed which eliminate the board, friction rollers, gears, clutches and other such appurtenances which mark the ordinary steam drop hammer. Compressed air at a pressure of 60 to 100 pounds is required, striking a blow of between 250 and 350 pounds. The air consumption is but 3 cubic feet of free air per minute at 60 pounds pressure, or about 5 cubic feet at 100 pounds pressure.

The Buffalo Foundry & Machine Co. of Buffalo, N. Y., are now supplying their bell hammers for compressed air operation. Fig. 10 shows a typical plant, consisting of the hammer, a receiver and short-belt motor-driven compressor, complete with necessary valves and gauges. It is claimed for these outfits great flexibility and the same sensitive control as obtained from steam hammers. The force, position and rapidity of blow is under absolute control and can be varied instantly at the will of the operator.

Power is only used when work is actually being done and in forging the work is in direct proportion to the power being used. Maximum power is always available when the forging is at the highest temperature and, therefore, in the most plastic condition.

COMPARISON OF AIR AND STEAM OPERATION.

Compressed air is lively and instantly available for use, so that there is no delay when starting up in the morning or any time it may be wanted. Lubrication is simplified. When starting up the steam hammer it is usually cold and the steam condenses, the lubrication is partly washed out, and there is a lot of water dripping, so that you cannot put a forging under the hammer at once. If you do, the dripping water is likely to spatter and scald the operator. Nor can the forging always be left in the fire, waiting for the water to stop dripping, because it is liable to burn, and all this happens several times a day unless the hammer is in continuous use.

Fig. 11 illustrates a British pneumatic forging hammer. The author is indebted to the "London Engineer" for the following description:

"In the construction of the hammer itself the makers have followed very closely the design of their usual smithy steam hammers, believing this to be the most satisfactory form.

The hammer, instead of being operated by steam, is worked by a double-acting pump placed immediately behind, which supplies air in the place of steam at the top and bottom of the hammer cylinder at each stroke. The pulleys and crank are placed low down, in order to ensure steadiness for the hammer, and are of very compact design, so that they may be arranged within the standard. There are consequently no projecting parts, the hammer occupying scarcely more space than a steam hammer of similar capacity. A diagonal position has been given to the anvil block in order that the pallets on all sides may be accessible, and to allow of long bars being worked in either direction across the anvil. The hammer is controlled by a single valve, which is placed between the cylinders, and by varying the position of this valve by either hand-lever or foot-lever, the operation of the hammer is promptly and easily regulated by the attendant. When the levers are in their top position air is forced only under the hammer piston, and the tup is held at the top of its stroke, and remains stationary there. On either lever being depressed, the air passes alternately above and below the hammer piston, and the hammer begins to work. The further the lever is depressed the heavier the blow, until the full blow is given. Thus light or heavy blows, with long or short strokes, can be struck at will, the regulations being easy, accurate, and instantaneous. As soon as the lever is released the tup rises to the top of its stroke, and remains there. Another useful feature is that the tup can be held firmly down on the anvil when it is required to use the hammer as a vise. This frequently is convenient for bending work, and for holding it during various operations. We have had an opportunity of inspecting one of these new pneumatic power hammers in operation at Messrs. Massey's smithy, and also specimens of the work done, which afforded proof of its efficiency. The work comprised all varieties of forgings; and as a test of the largest work that can be produced by a 3-cwt. hammer as shown in the illustration, a steel billet 8 inches square was drawn down at one heat to 2¼ inches square and 28 inches long."

Of the actual transmission of the air for the service here spoken of very little need be said. It is carried in pipes the same as steam, but is more easily handled. As already brought out, there is no condensation and it may be carried any distance with very little loss in transmission.—*American Drop Forger.*

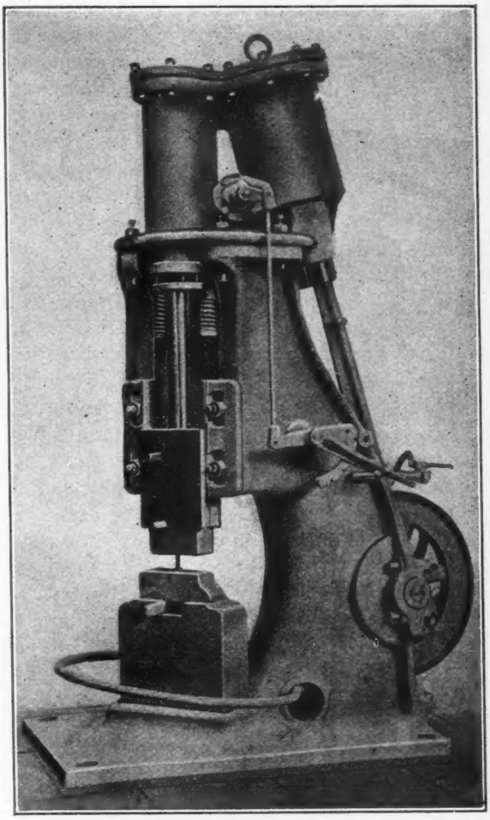


FIG. II

DETERMINING COMPRESSED AIR CONSUMPTION

BY HARRY H. BARCLAY.

One of the perplexing problems for foundrymen to solve accurately is involved in ascertaining the amount of compressed air used by air-driven machines. From indicator cards the cost of all of the air used can be determined readily, but to ascertain the actual cost on each separate casting or job is not so easy of accomplishment. Sometimes it is desirable to ascertain how many cubic feet of air are used in certain operations. Unfortunately, the tables compiled by authorities on the amount of air that will flow through an opening of a certain size in a given length of time, are not always applicable to existing conditions in casting plants.

Desiring to secure information regarding the amount of compressed air required per mold by different sizes of foundry vibrators, we proceeded as follows:

A small air compressor was used with a

shut-off valve located between the compressor and the tank and in the latter the air pressure was raised to 90 pounds. The valve was closed and with a stop watch the time was noted that elapsed for the vibrator to reduce the pressure to 70 pounds. It may be assumed that for all practical purposes this would be equivalent to 80 pounds mean effective pressure, the amount in most general use in foundries. To illustrate in even figures, it will be assumed that the tank holds exactly 10 cubic feet of air and that it takes the vibrator exactly two minutes to reduce the pressure from 90 to 70 pounds. Therefore we figure that the vibrator used 10 cubic feet of air in two minutes. By actual tests it has been found that the average time the vibrator is working while the molder is drawing a pattern is about 15 seconds and, therefore, we get eight molds with 10 feet of air and the vibrator uses 1¼ feet of air per mold. This same principle may be applied to any air-driven tool or molding machine and we believe that the results are more nearly representative of actual conditions than theoretical calculations.—*Foundry.*

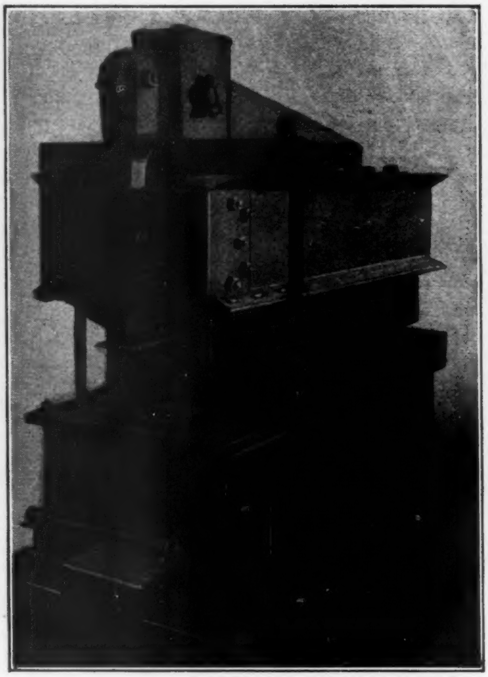
A HOME-MADE PNEUMATIC PUNCH

BY FRANK J. BORER.

The photograph shows a pneumatic punching machine which has now been in use for more than a year at the Elizabethport shops of the Central Railroad of New Jersey and has given entire satisfaction as regards service and output of work.

The frame of the machine is constructed from second hand bridge material and the few forgings required were made in the blacksmith shop. A second hand 16-in. air brake cylinder was used and no material had to be purchased to construct the machine, thus reducing the cost of construction considerably.

It is not the purpose of the writer to advocate the construction of a machine of this kind instead of purchasing a regular punching machine, but rather to draw attention to the fact that one or more machines of this kind could be used to advantage in small shops, in repair yards, scrap yards, etc., where the expense of a regular punching machine would be too great or where other difficulties, such as obtaining the necessary power, proper foundation and housing, limited floor space and the like would

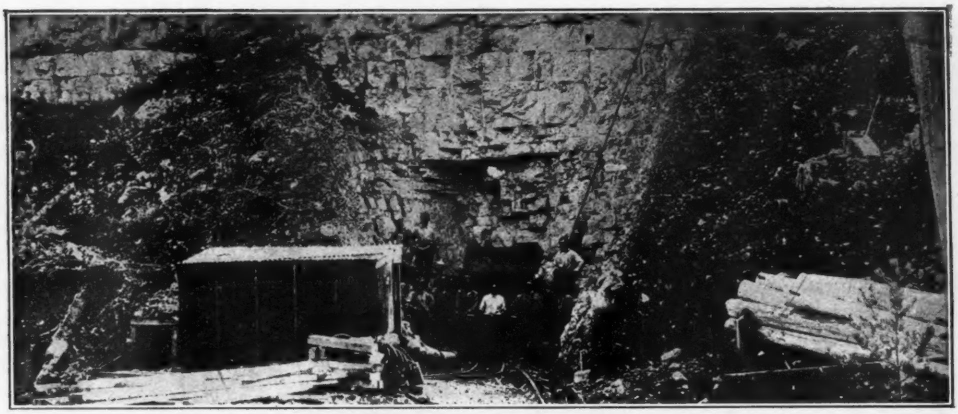


HOME-MADE PNEUMATIC PUNCH

prohibit the purchase of a punching machine of the standard type.

The pneumatic punching machine shown here does not need a special foundation and, in fact, can be made portable. Its capacity is sufficient to punch 15/16-in. holes through ½-in. iron or steel plates or its equivalent, with 90 lb. of air pressure. The power is obtained from the regular shop air supply line with a 1⅛-in. hose of suitable length. It is connected to the inlet part of a Westinghouse straight air brake valve. (It was found that this style of valve is more durable, easier to operate, and requires less repairs than does a three-way cock.) The air brake valve controls a 16-in. brake cylinder. When air is admitted to the cylinder, the piston engages a lever having a ratio of 4½ to 1. Punch dies and punches are made of the same dimensions and shape as those furnished with standard machines.

The straight air brake valve is operated by foot power, a spring attachment keeping the handle of the valve in the release position when not in use. The machine occupies a floor space of 3 ft. by 5 ft., and is about 5 ft. 6 in. high.—*Railway Mechanical Engineer.*



PORTAL OF HOMESTAKE HYDROELECTRIC TUNNEL

RAPID DRIVING OF A SHORT TUNNEL

BY H. L. HICKS

In driving the Homestake hydroelectric tunnel in the Black Hills of South Dakota, from Apr. 14 to Aug. 31 of last year, fast progress rates and low repair costs were realized.

The development consists of two tunnels, Iron Creek, 1096.7 ft. in length, and Long Tunnel, 3931.4 ft. With a 16.5-ft. adit these totaled 5044.6 ft. The work was contracted for by William B. Arndt.

The ground was a medium hard limestone for almost the entire distance, the exception being 200 ft. of every hard flint. The tunnel measures 7x7½ ft., but over-breakage would make the average dimensions greater than 7x8 ft. Work was conducted from six headings, compressed air for all being supplied by a 537-cu.ft. steam-driven compressor. The air pressure at the compressor ranged from 115 to 120 lb. and the lowest pressure at any of the drills was 90 pounds.

All the drilling was done with "Jackhamers," four of the wet type and six of the dry type. Nine drills were operated and the tenth held as a spare. The four water-feed machines were clamped in feed shell mountings of a new type (Fig. 1) and used with 3-in. single-screw columns. The other drills were, by the operators' preference, hand-held to save time, as the drillers could get back to work as soon as the heading had been shot.

The drilling round consisted of 14 to 20 holes, the usual layout being four 7-ft. cuts and ten 6-ft. side holes. Cross bits on ⅞-in. hexagon steel and ⅞-in. 60% powder were used throughout. Machine-sharpened steels were supplied from a central blacksmith shop.

The progress record is incomplete, due to periods when labor shortage made it necessary to halt work at one or another of the headings. The individual heading records are, however, rather remarkable. For instance, over a period of 41 days ending May 26, one heading was driven 8 ft. per shift or 24 ft. per day, the total being slightly over 1000 ft. Another heading, started May 2, was driven 350 ft. in 23 days of 3-shift work, running ten men per shift, using two drills. Still another case of consistent progress was that of a third heading, where 1543 ft. were driven in 86 working days between May 3 and Aug. 10, with 14 men per shift handling two drills. During this run the round was shot seven times every two days while at the other headings they shot but three times each day.

As to the last-mentioned heading, the contractors comment that "the men never saw the inside of these machines and I never had one of them in the shop until the heading was in 1400 ft." indicates that little drilling time was lost and explains the excellent average of 17.9 ft. per day at this heading.

Summing it up, the Homestake tunnel was driven fast when a full crew made it possible.

FIG. 1. SPECIAL DRILL MOUNTING

It is also to be noted that the drills set a good mark in low upkeep cost, the contractor recording a total repair expense of $289.85 or 5¾ cents per foot of tunnel.—*Engineering News-Record.*

USE OF COMPRESSED AIR TO PRODUCE CLEAR ICE

In the last few years great improvements have developed in the artificial production of ice for domestic use, and especially in the making of clear, solid, transparent ice from water, instead of the so-called "snow" ice which everywhere is very properly objected to. The most important detail of operation has been the use of compressed air for agitation during the process of congelation. This matter is interestingly discussed in a paper by Van R. H. Greene before the American Society of Refrigerating Engineers.

It is a familiar fact that all water contains air, and the presence of this in the water during the freezing period breaks up the crystal formation of the ice in such manner as to preclude the possibility of its freezing clear. This air can be expelled from the water either by boiling or by agitation, so as to drive the air particles to the surface. This latter principle is the one used in modern raw water can ice plants. The water in the freezing can is kept in continuous agitation by blowing air from an outside source into it, thereby maintaining a constant agitation. The agitated water washes the surfaces of the forming ice and drives to the surface the air particles, which otherwise would adhere to the ice. That this is true is proven by the fact that rubbing one's hand over the surface of partly frozen ice in the can enables one to judge by the degree of roughness whether the finished ice block will be clear or opaque. This means, then, in so far as the effect of air in suspension is concerned, that it is overcome by the present-day agitation processes, and it requires only an analysis of the water as to its mineral content to determine its suitability for manufacturing perfectly clear blocks of ice.

In order to keep the air passages always open, a pressure of 17 to 20 lb. per sq. in. must be exerted at the end of the air tubes to agitate the water continuously from the time the can is filled until the ice block is frozen solid. Therefore, in the modern high pressure raw water can systems theoretically it requires only a pressure of 20 lb. in the air laterals to produce the desired results.

HIGH PRESSURE AIR SYSTEMS.

At the present time there are in use two standard high pressure air agitating systems. One has the air tube suspended from the short side of the ice can, hanging inclined, so as to protrude into the ice itself without coming in contact with the walls of the can. In the other method a small brass or copper tube is soldered along the side or corner of the can, down to the bottom. In both of these systems a pressure of approximately 30 lb. is kept in the air laterals to produce the necessary air agitation.

A certain amount of air being contained in all water, so, likewise, there is a certain amount of water vapor suspended in air. When the air is cooled, this water vapor condenses in the shape of dew. The moisture thus precipitated tends to adhere to the sides of the drop pipe in the shape of ice, accumulating slowly but steadily until the air supply is shut off by the freezing up of the tube opening. To eliminate this entrained moisture the air must be subjected to a drying process, which usually includes compressing and cooling to such an extent that when the air is again expanded its dew point will be below that of the surrounding medium. This is much more difficult to accomplish where the pipe is in direct contact with the ice can, and therefore affected by the low temperature of the brine, than it is when the air tube is surrounded only by the forming ice. In the first case the air must be cooled to at least 20 deg. F., while in the second case successful drying is accomplished by cooling to at most 40 deg. F. To avoid the possibility of condensed water freezing in the dehydrator, used with the suspended-tube system, the pressure is kept a little higher than is absolutely necessary for holding the air temperature at 40 deg. F., which is sufficiently above the freezing point to prevent trouble. In case it is desired to operate with a pressure of only 20 lb. per. sq. in., effective drying can be produced by lowering the air temperature to 20 deg. F. with no more risk or trouble than in the fixed-tube system, where a temperature of 20 deg. is necessary to make this system operative under a pressure of 30 lb.

Much has been written on the chemistry of raw water ice, and great are the differences of opinion on this subject still, but unfortunately

it cannot be made the essence of this paper. I shall, however, add some useful observations pertaining to this subject from personal experience in the field.

QUALITY OF WATER IMPORTANT.

The average city water contains little mineral matter in suspension, except at such times as the spring freshets cause the water to become turbulent. Thus, an adequate filter may not be necessary during the major part of the year; still there are times when heavy drains are made upon it, and for this reason it should be sufficiently large to withstand this abuse and at the same time not become inoperative by clogging up. It is safe to say that water containing mineral matter in suspension in excess of two grains per gallon will not make clear ice without the installation of the necessary filtration system.

Another source of great trouble in raw water ice making is the organic matter which is always present. This is responsible in most cases for the yellow core seen in the product of some raw water ice plants. This yellow core becomes objectionable if the organic matter exceeds two grains per gallon. When present in smaller quantities, it should be removed by the addition of alum to the water in conjunction with the filtration system. If the organic matter is much in excess of two grains per gallon, then clear ice can be made only by the removal of the core prior to the ice block being frozen solid. Oxide of iron present in quantities exceeding 0.05 gr. per gal. will produce a similar discoloring deposit, and therefore requires treatment for its removal.

Calcium carbonate, in almost any quantity, will produce a lime deposit in the core of the ice block, and to prevent this it should be removed by a lime apparatus constructed for this purpose. It is generally safe to say that waters containing more than four grains of calcium carbonate per gallon should be treated for the removal of this lime, regardless of whether it is the intention of the operator to remove the core or not, as in practice it seems difficult to effect the complete removal of this substance by core sucking alone.

THE AIR SUPPLY.

Different kinds of water require different rates of agitation. With average water containing up to 15 gr. of total solids per gallon, from 0.2 to 0.25 cu. ft. of free air per min. should produce the necessary agitation to effect the freezing of a clear 300 lb. block of ice. With waters containing solids in excess of this amount the agitation should be materially increased.

In one plant, clear ice was frozen with only about one cubic foot of free air entering the ice can during the early stages of freezing and this quantity was gradually reduced until the ice block was frozen. Of course, a plant of this character is far too complicated to be called a commercial success, but the object of the experiment was to find out under what conditions marketable ice could be made from the particular water in question.

Practically, the limit of quantity of air which can be successfully handled per can on a standard high pressure system throughout the entire period of freezing is approximately 0.4 cu. ft. per min. If more than this amount is supplied to a block which is two-thirds frozen, the agitation becomes so violent that finally no water is left in the core.

THE REACH OF THE WAR

The following items, not apparently related, are taken from a single article in a recent issue of the *Saturday Evening Post*.

CANARIES AND MICE FOR THE TRENCHES

One day not long ago the War Department received a telegram from General Pershing, reading:

"Send one thousand canaries and one thousand white mice."

The message was sent to the chief purchaser for the expeditionary forces. He read the words and sent the dispatch back to the Secretary of War with the request that it be uncoded. The code room of the War Department returned it with a note saying that it could not be uncoded, that it was just a plain telegram.

The purchaser was baffled. He did not know whether the telegram was a joke or an order, so he consulted a former United States military attache in France.

"Do you suppose that General Pershing actually wants white mice and canaries?" he asked the captain, handing him the cable.

"Yes, sir!" was the military reply. "White mice and canaries are placed in the first-line trenches because they can detect poisonous gases much quicker than the soldiers. When a soldier sees a canary bat its wings or a white mouse trying to bury its nose he understands

that it is high time for him to put on his gas mask. White mice and canaries have saved thousands of lives in France, and we should supply our army immediately."

It is hardly necessary to add that the United States purchased the white mice and canaries at once and shipped them to France, and in doing so we almost exhausted the supply.

BARGAINING FOR LOCOMOTIVES.

One day General Pershing telegraphed for several hundred locomotives to be used on the railroads which American engineers are constructing in France. The order was sent to a former president of a Mid-Western railroad now acting as chief purchasing agent for General Pershing. This official went to the president of a large locomotive concern. He informed the manufacturer that the United States needed so many hundred engines immediately for service abroad.

He brought the specifications and asked for an immediate estimate of cost. The president of the company said that in view of war conditions, of the high cost of materials and labor, and because the Government desired immediate delivery, the price would be $75,000 per locomotive.

"I cannot understand why the price is so high," the official is reported as having said, "because when I was the chief executive of a Western road I bought these same engines for $50,000 each. In view of this the Government will not pay $75,000 each on this order."

He returned to Washington, unable to come to an agreement with the manufacturer. Being one of the men more or less officially responsible to President Wilson, he informed the Chief Executive that he believed he could purchase the engines for $50,000 if he could be assured of the President's support. The President told him in his very definite and firm way that he should buy the locomotives at whatever price he considered reasonable to the Government and the manufacturer. In doing this, the President said, he could be assured of the Government's support.

The next day the Government purchaser went to the manufacturer with a contract. He said in effect:

"The United States Army in France needs —— hundred locomotives. Two months ago I bought these same engines for $50,000 each. I have a contract here which the United States has already approved. I am certain that you will be making a good profit on this contract at the price I suggest."

And then he presented the contract, which was signed by the manufacturer.

On this one purchase alone the United States was saved many million dollars, and the man who saved the money is receiving one hundred cents every 365 days.

EDISON AND THE SUBMARINES.

One afternoon at two o'clock Mr. Edison called at the White House and asked to see President Wilson. At three minutes after two the great inventor was in Mr. Wilson's personal study in the residential wing of the executive mansion. By two-thirty the conference was concluded and the President himself made an appointment for Mr. Edison with Secretary of the Navy Daniels. That afternoon a new anti-submarine device was explained to a selected board of naval officers. The navy was as quickly convinced as was the President, and by seven o'clock the next morning Mr. Edison and a naval staff, aboard an American warship off the Atlantic Coast, were testing the invention on an American submarine, which was previously instructed to attempt to sink the ship!

So successful were the tests—it is not compatible with public safety to reveal the nature of the scheme—that within thirty hours after the invention was explained to President Wilson it was officially adopted by the American Government.

THE CHINOOK

The little town of Casper, Wyo., reported a curious experience a few days ago. It got out of bed to find the mercury 4 below zero. At 4 in the afternoon the temperature was only a few degrees higher, but at 6 o'clock the mercury had jumped to 60 above zero. This sudden change was due to what the people of the mountain country call the "chinook." The chinook is a hot dry wind that occasionally visits communities in Montana and Wyoming, licking up the snow in front of it like a blast from a furnace. Its effects seemed miraculous to the Indians and the early white settlers. But investigators long ago discovered the explanation. The chinook usually occurs on the eastern slope of a mountain range. An air current blowing over the west slope expands and cools as it rises toward the mountain summit, and precipitates in snow most of

its moisture. When it begins rushing down the eastern slope it is exceedingly dry and it warms rapidly by compression. On account of its lack of moisture it rapidly dries the ground over which it passes. These winds sometimes persist for days in the Alps and everything becomes so dry that precautions have to be taken against fires. In Europe the chinook is called the foehn. Before the development of weather science the hot dry air that poured down the Alpine slopes was supposed to have come from the Desert of Sahara. Now it is known to be no different from the phenomenon that meets every boy who pumps up a bicycle tire and discovers that compressed air is warm.

[The above we reprint from the Kansas City Star. The explanation of the phenomenon described cannot be regarded as satisfactory in so far as the rise of temperature is attributed to the compression of the air, since the actual compression is comparatively so slight.]

PRECOOLING VENTILATING AIR FOR ELECTRIC GENERATORS

BY JOSEPH T. FOSTER.

The question of whether to install air washers or humidifiers for conditioning and cooling the air entering generators is particularly pertinent at this time, since by cooling this air the generator capacity may be increased from 10 to 20 per cent. Furthermore, by cleaning the air possible shut-downs for generator cleaning and, what is more serious, possible burn-outs due to heavily loaded, dirty machines, may be avoided. Obviously, then, this is the quickest and cheapest method of increasing power plant capacity, and as electric companies are at this time confronted with long deliveries, delayed shipments due to present transportation conditions and labor shortages, this subject should receive special attention now.

The purpose of central station companies in including the air washer as standard equipment on turbo-generator installations is twofold:

1. For supplying clean air, free from dust which would coat the windings of the generator and form an insulating covering.

2. For precooling the air by evaporation of water when the air passes through the film of water atomized by the spray nozzles.

Before air-washing equipment was used it was found that the dust and dirt incidental to the unloading of coal and the disposal of ashes fouled the generator by coating the air passages. It was therefore necessary to shut down the generator at least once a year for a period of five or six days for cleaning purposes. In addition to the expense of cleaning there was the inconvenience and loss of revenue due to shutting down the unit.

Some idea of the cleansing effected by a modern-type air washer can be gained from tests which showed that it was possible to blow several pounds of soot per minute into the intake and have the air at the generator inlet perfectly free from dust.

There is a more or less widespread belief that the humidifying of the air increases its cooling capacity on the ground that wet air, on account of its higher specific heat, has greater heat-absorbing properties. The effect of this change in specific heat is negligible as far as heat absorption is concerned, because the weight of water vapor present even in saturated air is very small as compared with the weight of the air itself. The difference in the amount of heat absorbed by saturated air as compared with dry air under a given set of conditions is not more than 1 or 2 per cent.

The precooling action of the air washer is, however, of importance. Assume a 12-500-kva. unit which requires 30,000 cu. ft. (850 cu. m.) of cooling air per minute and in which the losses amount to approximately 300 kw. at full load. The heat aborbed per hour, assuming a final temperature of 100 deg. Fahr. (37.8 deg. C.), neglecting the moisture in the air, will be as follows:

I. Air not precooled and entering the generator at 68 deg. Fahr., $0.24 \times 0.07524 \times 1{,}800{,}000\ (100-68) = 1{,}040{,}000$ B.t.u.'s per hour.

II. Air originally at 68 deg. Fahr., but cooled in the washer to 53 deg. Fahr., $0.24 \times 0.07788 \times 1{,}800{,}000\ (100-53) = 1{,}580{,}000$ B.t.u.'s per hour.

In the first case, the losses absorbed amount to 1,040,000 B.t.u.'s per hour, or 305 kw.; in the second to 1,580,000 B.t.u.'s per hour, or 463 kw. It may be assumed with fair accuracy that the losses are proportional to the squares of the currents; therefore, $I_2^2/I_1^2 = 463/305$, or $I_2 = 1.23 I_1$. The terminal voltage is, of course, constant, hence the kilowatt output when the air is precooled will be theoretically 23 per cent greater than with air at the higher temperature. It is more probable, however, that in

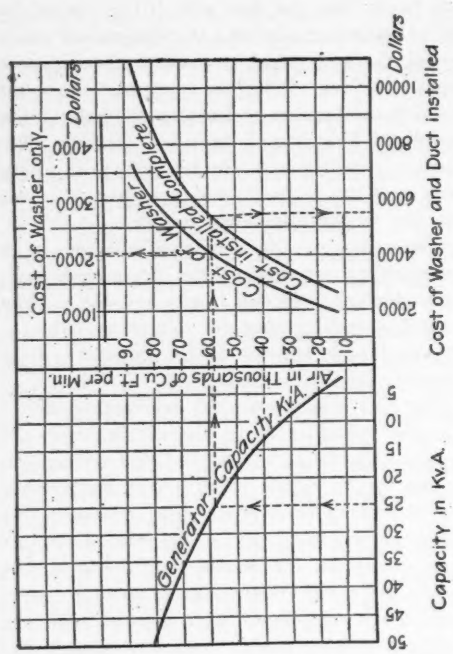


FIG. I

practice the gain under the conditions stated would amount to 15 per cent, although gains of 20 to 25 per cent have been realized even where the natural conditions were particularly adverse.

The gain in generating capacity obtained by precooling the ventilating air is large, but is obtained by the expenditure of a comparatively small amount of money, as shown in Fig. 1.

The use of the chart is illustrated by the following:

Problem.—Given a 25,000-kva. generator, to find the amount of cooling air required, the cost of the air washer and the cost of the washer installed in place.

Solution.—From the intersection of the vertical line through 25,000 kva. and the curve, run horizontally to the vertical scale. The required air is 58,000 cu. ft. (1640 cu. m.) per minute. Running horizontally to the intersection with the first curve, read on the upper scale the cost of the air washer as $2,050. Running horizontally to the second curve, read on the lower scale $5,500 as the cost of the complete installation.

An illustration of an air-washer installation used in connection with a turbine plant is shown in Fig. 2. The air, which is drawn through louvers and screens at the left, passes through the washer and then through the generator, from which it is discharged direct to the forced-draft blowers in the boiler-house basement.

This method of operation is employed during summer weather when it is desired to obtain the coolest air possible for the generator. The discharge to the forced-draft blowers of this quantity of heated air improves the boiler efficiency somewhat and maintains a lower turbine-room temperature.

Under winter conditions the louver opening in the outside wall is closed by a rolling door and the air is drawn into the washer from the turbine room through the side door and discharged from the generator bypass through the sliding door provided for that purpose. Under these conditions the door into the boiler-room basement is closed.

This method of recirculating the air from

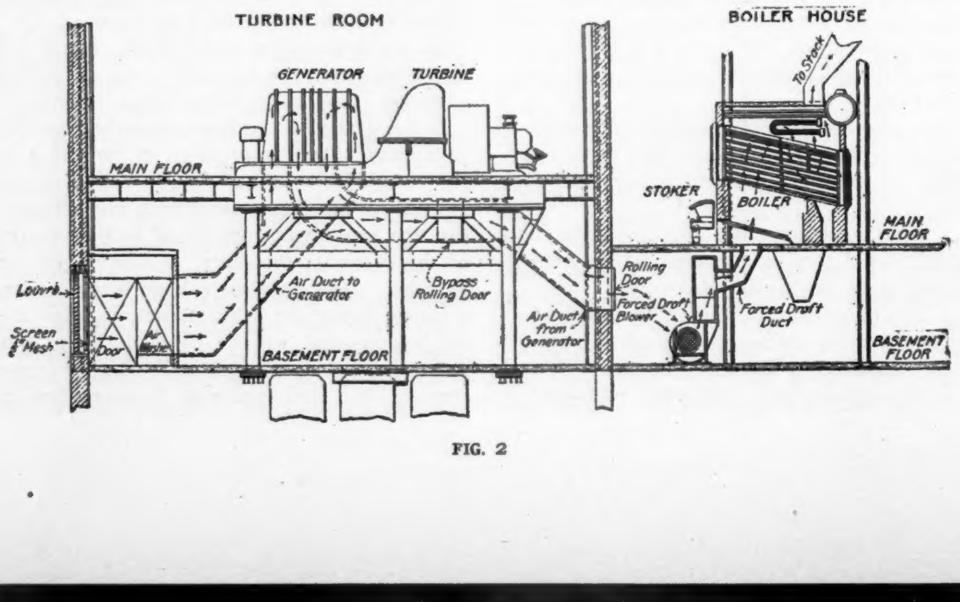


FIG. 2

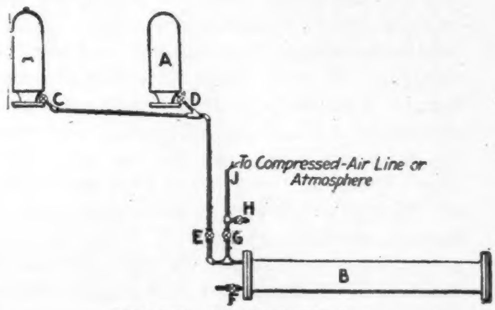
the turbine room keeps the room at a comfortable temperature. It also does away with the inconvenience of having a partial vacuum in the turbine room due to the removal of large quantities of air from an inclosed space.

The washer to be purchased by the engineer should be of the size specified or recommended by the generator manufacturer, of the heaviest and most durable material, and able to cool the air to at least 85 per cent of the difference between the wet and dry bulbs. At the same time the air resistance through the washer should not exceed 0.375 in. (9.3 mm.) of water and the power consumption should be kept down to a minimum.—*Electrical World.*

A LIGHT AIR DRIVEN ROTATING DRILL

The Ingersoll-Rand Company has added to its line of "Little David" pneumatic tools a new light-weight, high-power, non-reversible drill especially adapted to that class of drilling and reaming work which may come within its capacity limits of reaming up to 5/16 in. and drilling up to 9/16 in. This new drill has been designated No. 5 "Little David." It weighs 15 lb. and develops a free spindle speed of 1000 r.p.m. With drill chuck its over-all length is 14⅝ in. and the distance from side of drill to center of spindle is but 1½ in., which facilitates its operation in unhandy places. The spindle is threaded to accommodate either a No. 1 M.T. socket or drill chuck, and these may be readily interchanged as desired.

The four-piston motor is very simple and the convenient accessibility of the reciprocating parts is pointed out to be of advantage. It is stated that the removal of five caps screws permits the crankshaft assembly to be withdrawn in its entirety. The valve is of the rotary type and is gear driven. Roller bearings are used on the connecting-rods and ball bearings on the crankshaft. The No. 5 "Little David" may be had with either breast plate spade handle or telescoping feed screw. In the latter case the length of feed measures 2½ inches.



FILLING AIR CHAMBERS

TO FILL PUMP AIR CHAMBERS WITH HIGH PRESSURE AIR

BY W. A. MC CURDY.

Following is a description of a scheme which is simple and inexpensive, but which works wonders on pumps operating against high heads, by filling the air chambers with air at a pressure equal to that due to the hydraulic head. This device is not new, but is of value.

IMPORTANCE OF THE AIR CUSHION.

When we stop to think that a cylindrical air chamber 30 in. long, filled with air at atmospheric pressure, will have but the top one inch of its length full of air when working under a 1000-ft. head, it is evident that the air chamber is of no use, while with this same chamber full of air at the proper pressure, there is a perfect cushion to absorb the shock due to the sudden thrust of the pump plunger against the end of a long, heavy column of incompressible liquid.

HOW IT ACTUALLY WORKED.

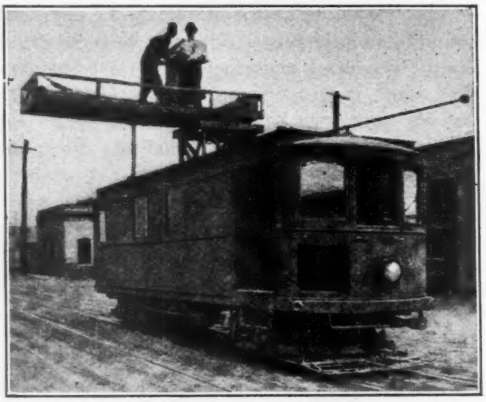
There are in the mines of the Oliver Iron Mining Co. on the Vermilion Range several crank and flywheel pumps of about 1000 gal. per min. capacity, operating against a head of

approximately 1000 ft. A speed of 38 to 40 r.p.m. was about the limit of safety prior to the installation of this device. On account of the heavy water-hammer, it was impossible at higher speeds to prevent gaskets from blowing out, fittings from breaking and undue wear and tear due to the excessive vibration of everything connected with the pumping plant. With this device in use, the same pumps can now be operated at 55 to 60 r.p.m. as noiselessly and smoothly as a new sewing machine. In other words, the pumps may be run right up to capacity without difficulties of any sort.

Referring to the attached sketch, the device consists of a length of heavy pipe *B* which may be 8, 10 or 12 in. in diameter and 16 or 18 ft. long, the ends being closed with blind flanges. One flange is drilled and tapped near the bottom for a 1½-in. pipe which will drain the large pipe, and near the top for a 1-in. pipe. From the 1-in. opening pipes lead to the air chambers *AA* and to the compressed air line or atmosphere through *J*. There are 1-in. globe valves suitable for the high pressure at *C, D, E, G, H* and *I*. At *F* is a 1½-in. valve. The pipe *B* should be level and the 1-in. pipe *CDE* should be continuously up-grade from *B*. There should be no point in this pipe as high as the point *C*, otherwise the air will be trapped and cause the device to operate slowly or not at all.

Operation is as follows: Valves *C, D* and *H* are open. Valves *E, G, F* and *I* are closed. Now open *F, G* and *H* or *F, G* and *I*. This will drain or blow all water out of *B*. When *B* is empty, close *F* and *H*, leaving *G* and *I* open till *B* is filled with compressed air at 60 to 75 lb. pressure or with atmospheric air if there is no compressed air handy. Now close *G* and *I* and open *E*. Water will now flow from *AA* to *B* compressing the air in *B* to pump pressure, after which this air will bubble up through pipe *EDC* to the air chambers *AA*. After a few minutes close *E*, open *F* and *G* and repeat operation till air chambers are full of air. This will be known when the valve *F* discharges air instead of water. Two of these operations are sufficient for the pump previously mentioned. It might be well to have a trycock in one air chamber just above where *C* or *D* enters.

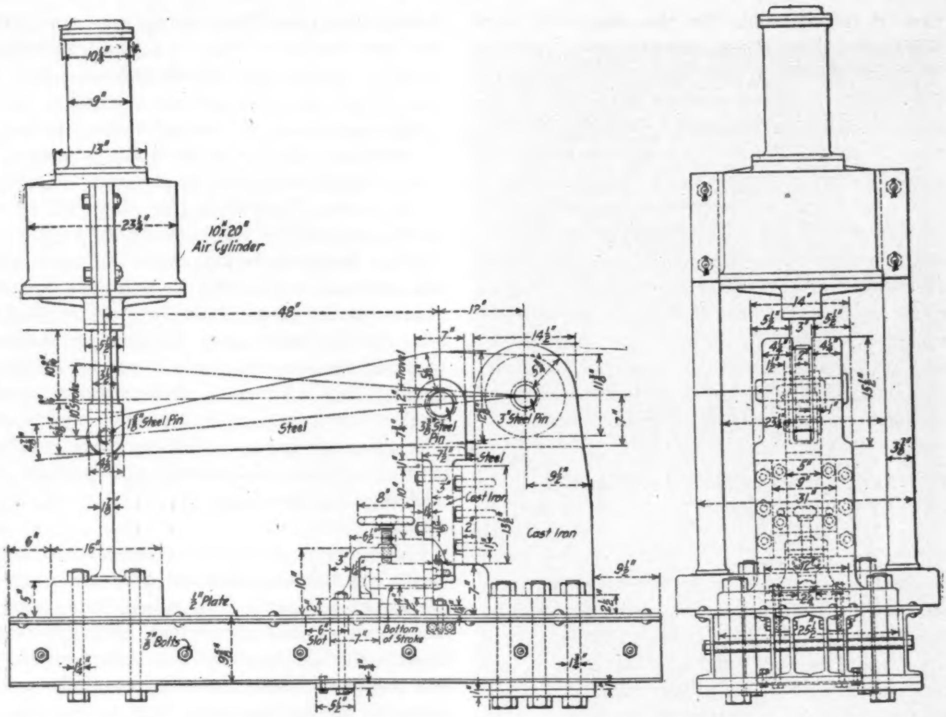
The valves *H* and *I* are not necessary when air is taken from the atmosphere. They are merely a safeguard against water entering the compressed-air system when the device is idle. To prevent this *H* is left open to drain off any water leaking by *G*. Doubtless the device can be still further simplified and improved—*Eng. and Mining Journal.*



AIR ELEVATED WORKING PLATFORM

The half-tone here reproduced from a recent issue of Electric Railway Journal shows a compressed air operated device which will be easily understood and at once appreciated. This is a line repair car operated by the Washington Water Power Company, Spokane, Wash., the working platform of which is raised and sustained by compressed air, the air always ready in the air brake system. There is a vertical cylinder 10 in. dia. and 7 ft. long firmly secured in permanent position in the car, and in this is a piston or plunger to which the platform is attached. The working height desired is immediately adjusted by the manipulation of a valve at either end of the car. There are by-pass ports which prevent overtravel in the lift, and roller bearings permit easy rotation all around the circle. The air pressure will hold the platform with two men working on it for twenty minutes, but independently of that means of locking are provided when longer periods of work occur. The working platform, 14 ft. by 4 ft., is locked lengthwise of the car when not in use. The entire roof of the car is planked so that the crew can use it for working purposes.

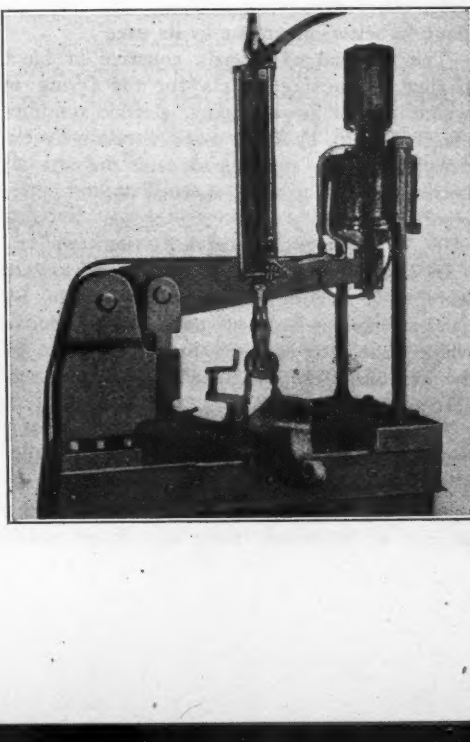
In the midst of a war that will be won by steel wrought into ships and shells, the American steel industry, grown into giant stature, produced in 1917 nearly three tons to every two tons in the rest of the world.—*Iron Age.*



PNEUMATIC RIVET SHEARING MACHINE

BY E. A. MURRAY.*

The device for shearing coupler yoke rivets shown in the illustration can be made at slight expense and, it being easily portable, it enables the yoke rivets to be cut at any point where compressed air is available. The saving effected by eliminating the necessity of carrying coupler yokes to the shear is quite considerable. The base of the machine consists of two 9-in. I-beams and four 9-in. channels to which are riveted two ½-in. steel plates. At one end of this frame is placed a yoke which carries two air cylinders, the upper one of which serves as a dash pot. The lower one is 20 in. in diameter and the upper 7¾ in. At the other end of the frame is bolted a heavy casting which serves as a fulcrum for the steel arm which carries the shear and shear blade. Directly under the shear blade is bolted a block which serves as a support for the coupler yoke when the rivets are being cut, the other side of the yoke being held up at the same time by a movable bracket to which is attached a handwheel, which is attached to a screw. By tightening this screw after the coupler is in posi-



*Master Mechanic, Chesapeake & Ohio, Clifton Forge, Va.

tion, it is impossible for the coupler to turn when the shear blade comes down upon it. The arm to which the shear blade is attached is of steel. It has a travel of 2 in. and is guided by a slotted casting, bolted to the fulcrum casting. The lever, which is attached to the cylinder is of steel, the proportions being such that a leverage of five to one is obtained on the shear A lateral movement for the pins in the piston rod and the shear arm is provided for by slotting the holes in the lever. The air to the machine is controlled by the 3-way valve shown just below the large cylinder and at the left. A coupler is shown in position for shearing, suspended by an air hoist in the middle of the picture.—*Railway Mechanical Engineer.*

ECONOMY OF COMPRESSED AIR FOR STREET SURFACE OPENINGS

BY H. L. HICKS.

The labor problem in municipal work, as in other fields of construction and maintenance, is calling for increased effort to replace men, who cannot be had, with machinery. For certain phases of the work pneumatic drills and kindred tools have proven their worth. Such drills as the Jackhamer, a 40-lb. self-rotating hand hammer drill, have taken almost entire possession of the field of rock removal in municipal contracting. It is but natural that, as contractors came to appreciate the handiness of a tool, they should begin to think of jobs, other than rock drilling, that could be done to better advantage by its use.

The removal of asphalt, concrete or block paving in opening streets for the laying or water, gas or sewer piping, electric conduits, etc., has been, by hand work, a relatively expensive job. By applying air tools the cost has been lessened, the work speeded up and better results obtained.

REMOVING CONCRETE PAVING.

In Des Moines, Iowa, electric service lines were to be laid in underground conduit. By hand methods it had been necessary to remove whole panels of concrete paving, in spite of the fact that a narrow trench was all that was needed.

The engineer introduced the jackhamer and it was demonstrated that by using the air drill it was possible to restrict the cutting to a strip about a foot in width; a decided saving in the amount of pavement torn up. Hand work would have cost about 40 cts. per foot. With the introduction of two drills and an electric portable compressor it was estimated that the figure could be cut to 30 cts., but actual results showed a cost of 18 cts. per foot.

REMOVING CONCRETE WITHOUT BLASTING.

In cutting concrete, under such conditions as in the subway construction in New York City, where the problem has been merely to tear out paving, foundations and other concrete without blasting, it is common practice to use a pointed chisel rather than the usual rock drill bit. As the rotation of the steel is unnecessary, shanks are made round instead of hexagonal. This, of course, renders the automatic steel rotating action of the drill superfluous. The chisel bit is very effective where concrete is of 3 or 4-in. thickness, as it permits the wedging and breaking off of relatively large chunks.

The problem of concrete pavement cutting has led to the adaptation of other air tools to the work. On part of the subway work, above mentioned, a heavy riveting hammer, when fitted with suitable chisel, was found an excellent pneumatic pick. In other cases the pneumatic tie tamper has been fitted with a sharpened pick and developed into a conveniently handled concrete remover. In removing concrete pavement preparatory to replacing the rails of a Chicago street railway a strip 6 to 8 in. wide was torn out at a rate of 30 ft. per man per hour. Average performance reports indicate that pneumatic equipment will better the working speed of a gang of twice as many men using hand picks.

REMOVING ASPHALT PAVING.

Somewhat akin to concrete removal is the taking up of asphalt paving. For this service the tie tamper is a time and labor saver. A flat chisel of about 3 in. width is used. First the pavement is scored with the tool in an inclined position. . Then it is held upright and the paving cut through and pried up. This method of applying tie tampers was developed by the street railways and shows such excellent saving that it will be undoubtedly applied by municipal contractors to similar work. At Elmira, N. Y., four men removed approximately 600 sq. ft. per hour, at a fraction of the cost of hand work.

Another tool also used for the same work is a smaller hand pick. With this tool narrow grooves are cut, marking the portion of the

asphalt to be removed, at an average rate of 20 lin. ft. per hour.

REMOVING BITULITHIC PAVING.

Bitulithic pavement, being softer and of somewhat sticky nature, is removed in a slightly different manner. A chisel some 1½ or 2 in. in width is employed to make a series of cuts, each the width of the chisel and spaced about 2 in. apart. Cuts of just sufficient depth to mark a distinct cleavage line are made on one side and the ends; the pavement is cut through on the remaining side, a crowbar is slipper under and the block or slab of pavement pried out. At Portland, Oregon, pavement of this kind was removed in slabs 4-ft.x4½ ft. at a cost of 49 cts. per square yard.

REMOVING BLOCK PAVEMENT.

In tearing up block pavement any of the tools can be used, although a hand hammer is most useful when it comes to toothing out the edges of the section removed or cleaning used blocks of the adhering binder. With the introduction of air hammers a marked reduction in the breakage of blocks is to be noted. In one city where air tools are used it was found that a five-man gang using two hammers removed and cleaned 2,000 paving bricks in an 8-hour day—as compared with 1,000 brick for 10 men working by hand.

Entirely aside from the benefits derived from reduced cost of working is the improvement in public relations resultant from the shortened elapsed time during which streets are closed to traffic.

GUN FOR DIGGING SLAG

The half-tone shows in use a "gun" for loosening slag from open hearth slag pockets recently placed on the market by the Rivet Gun Cutting Company, Cincinnati. By the use of this tool skilled labor is dispensed with and the labor cost is reduced. By its use the operator strikes a blow many times harder than is possible with a sledge, and the blows are repeated fifty times as fast.

There is an eight pound piston with a twenty-six inch stroke operated by compressed air, which may give an idea of the force of the blow. The air is controlled by a three way valve and the blows may be heavy or light and slow or rapid as desired. The force of the blow is cushioned by patented devices, so that the tool has no self destructive features and it does not "kick the operator." It is extremely simple and does not get out of order. The usual shop air pressure of 60 to 80 pounds gives the best results.

PROPOSED SPECIFICATIONS FOR AIR LINE HOSE FOR PNEUMATIC TOOLS

At the last annual meeting of the American Society for Testing Material a committee report was submitted containing tentative specifications for air line hose for pneumatic tools. The specifications cover wrapped air line hose suitable for air tools working at not more than 125 lb. pressure and for vacuum outfits. Extracts from the specifications follow:

The hose shall consist of: (a) An inner rubber tube; (b) cotton reinforcement; (c) an outer rubber cover; (d) when specified, an extra covering of cotton wire.

The rubber tube shall be smooth, uniform in quality and thickness, and free from injurious defects.

The reinforcement shall consist of cotton

canvas plies made from duck evenly and firmly woven from good cotton, as free from unsightly defects, dirt, lumps, knots and irregularities of twist as is consistent with the best manufacturing practice. It shall be well frictioned on both sides with a rubber compound suitable for the required service. The plies shall be laid on the bias and be sufficiently strong to enable the hose to successfully withstand the hydrostatic pressure test; yet at the same time be soft and pliable.

The rubber cover shall be uniform in quality and thickness and be free from injurious defects.

When specified, the hose shall be given an extra covering of one of the following, as specified: (a) An armor of half-round wire 7/32 by 5/64 in. spaced ¼ in. part; (b) canvas; (c) cotton braid.

Unless otherwise specified, the hose shall be furnished in 50-ft. lengths. The ends of each length shall be uncapped and without fittings.

The mimimum tube and cover thickness shall be as follows:

Size in.	Minimum Tube Thickness. in.	Minimum Cover Thickness. in.
⅜	1/16	3/64
½	1/16	3/64
⅝	1/16	3/64
¾	3/32	1/16
1	3/32	1/16
1¼	3/32	1/16

TREACHEROUS MINE-GAS MIXTURE

"Yes," said the mine boss to the master mechanic, "you probably have the hardest job in the world; but one thing is true, you don't have to contend with gas except what is generated in the shop by some of your able imitators."

"Oh, I don't know," replied the master mechanic. "I have noticed we never have to speed up the fan when you are down in the mine. You always seem to carry plenty of breeze along with you."

"Maybe," answered the mine boss, "but I can recollect two or three times when I wished my lungs were air compressors. Did I ever tell you about the time I set off the fireworks for the ladies?"

"I expect you have," replied the master mechanic, "but the story will be so much different this time that I probably won't recognize it, so go ahead."

"I do have to stretch them sometimes," returned the mine boss, laughing, "to keep from being completely outclassed, but this is a true story."

"When we were driving old No. 1, we ran into a fault where the coal pinched down for a distance of 60 ft. or so, and like most faults in this mine, the seam carried a small amount of gas. There was not enough of it to require using safety lamps, and it was customary for the miners when they started work in the morning to blow it about a bit with their coats and then set it off. The flame would sweep back a foot or so from the roof for maybe 20 ft. from the face, which was all there was to it. The men could then put in their shift without any more trouble.

"Well, one Sunday the 'Old Man' came out with some of his friends who had never seen a mine, and wanted to show them around. There was the boss and his wife, this gentleman and his wife and their daughter, a young lady about twenty."

"We now come to the point of the story," interrupted the master mechanic. "Brave Mine Boss Saves Beautiful Heiress from the Flames. Undying gratitude. Generous reward. Raise in salary. Yep, I see it all."

"You see nothing, as usual," replied the mine boss, testily. "This is what really happened. I took the party down and showed them the workings. We went part way up in No. 1, and the boss, who knew how we were working the gas, thought it would be interesting to show how we burnt it out. I didn't like the idea very much, but I agreed; and while the rest of them waited back down the entry, I went up to light it off.

"Well, sir, there must have been a little more than usual, because before I got to where we ordinarily lit it, away she went; and the first thing I knew I was flat on the bottom, wallowing in a puddle of mud. In the excitement all the lights went out, and the women were yelling and scrambling in the dark down the gangway.

"Old Jake Crosby, who was master mechanic at that time, was along, and I hollered to him to light up. He didn't answer, but as I got up I saw somebody coming from 'way down the entry. It was old Jake. And I bet he must have run 50 yd. in 4 sec. He came hurrying

up all excited and shouting, 'Is everybody all right! Is everybody all right!'

"No damage was done except that I ruined a good suit and got a nice hair singe free; but believe me, I learned a lesson right there. Never again. I wouldn't even light a gas jet now for the Queen of Sheba!"—*Coal Age.*

EXPLOSIVE MIXTURES IN BOILER FURNACES

BY GILBERT RUTHERFORD.

Probably every one who has operated boilers has at some time encountered the furnace explosion that blows fire doors open and singes the fireman's hair with the hot flame or blows coal particles into his face or eyes. The incident is not uncommon and, although potentially a dangerous occurrence, fortunately in most cases causes only temporary disability. The use of so-called low-grade fuels at this time of coal scarcity and high prices for marketable coal tends to increase the seriousness of furnace explosions. A brief discussion of their cause and prevention, based on the writer's experience, may therefore be of value.

Furnace explosions happen either when the furnace door is opened or when it is closed. The reason for the explosion is the same in both cases, but the manner in which the explosion is brought about is different in the two cases.

Consider an instance where a furnace is incased in a setting that is new and airtight so that air infiltration is eliminated by plastering up cracks and crevices, etc. No air enters above the fuel bed, and the furnace chamber is filled with combustible gases. The fire doors are closed and the furnace is operating, and at fairly low rate of combustion, which means comparatively high draft for a thick fuel bed. The fireman now opens the fire door to throw on some more coal or to look at the fire or rake it over. There being a difference of pressure between the inside and the outside of the furnace chamber, such that the air rushes from the outside to the inside, the air from the boiler room is caused to rush in immediately and mix with the combustible gases above the fire. Combustion occurs instantly and with such rapidity that it has an explosive effect, blowing out the gas and coal into the face of the fireman. The simplest remedy is to maintain balanced pressures, or nearly so, between the inside and outside of the furnace chamber.

Another common cause of explosion is in cases where the furnace doors are closed after being opened. Suppose a fireman throws a shovelful of slack coal—for example, anthracite dust—upon the fire. To prevent cooling the fires he opens the door wide, throws in the coal as quickly as possible and shuts the door again immediately. While the fire door is open the furnace settings fill with air, partially at least. The slack coal thrown on the fire spreads over the fuel bed and combustible gases are distilled. The gases rising from the fire may contain as much as 30 per cent of combustible. This mixes with the air entrained in the setting, the mixture becomes ignited, a small explosion occurs, and the fire-door of the furnace is blown open with considerable force as a consequence.—*Electrical World.*

A GARAGE DANGER

The poisonous character of the fumes arising from a gasoline engine may be appreciated by the following extract from a recently published book: "If a gasoline engine, producing 5 cu. ft. of CO per minute were allowed to run in a tightly-closed garage that was 12 ft. high, 15 ft. long and 15 ft. wide—that is, having a capacity of 2,750 cu. ft.—it could produce an atmosphere, if the latter were thoroughly mixed, containing about 1% CO in about five minutes. This percentage of CO in air is a fatal proportion, and would probably kill a person in less than a minute. In fact, an exposure for as long as 20 minutes to an air containing as little as 0.25% CO would make most people very ill."

FOR MACHINE DRILL SHARPENERS

For many years machine or power sharpeners have been used at mines, but contractors have been rather slow in adopting machine sharpeners except where a large number of drills were in use. The labor cost of sharpening bits with a machine sharpener averages about one-third the labor cost of hand sharpening (see Gillette's Handbook of Rock Excavation, p. 56, etc.), and the total cost is about half as much for machine work as for hand work. But this is not the only economic advantage, for machine sharpened bits require less frequent sharpening and the drilling speed is often 15 per cent greater than where hand-sharpened bits are used. A machine operated

by one man can repoint 60 bits an hour, and the bits are perfectly uniform. Even where there are so few drills that a drill sharpening machine cannot be kept busy, it pays to own one.—*Engineering and Contracting.*

LEARNING THE GAS MASKS

The "Little Green Door" behind which lies the gas chamber to accustom soldiers to German vapors had an extraordinary fascination for American troops to-day.

A steady stream of queer, gnomelike, olive drab clad boys passed through the door to-day, all with masks firmly adjusted, and emerged plainly tickled at the unique experience. The entire first contingent is being schooled in the gas chamber.

One youngster from New York city, whose comrades had kidded him about the deadly effects of the gas and the terrible perils of the test, fainted twice before he underwent the ordeal. Then in true soldier fashion he took a brace on his nerve and went through without a quiver.

The "Little Green Door" is the entrance to a sort of cave dug in the hillsides, its roof supported by timbers, the whole covered with sod and sandbags. A personal experience with the test proves it is a spooky stunt and as hot as a Turkish bath. Not a trace of gas penetrated the masks of any of the American soldiers.—*Daily paper.*

E. C. Drew has been serving a six-year sentence in the federal prison at Atlanta, convicted of using the mails to defraud. He sold stock in a company which proposed to drill for oil near Cordova, Louisiana. Recently a well was opened on the ground with a good flow of oil, notwithstanding the fact that experts had testified at the trial that there could be none there. It is merely a little story of the chances of life; but what is the answer? Is Mr. Drew not entitled to some compensation for the ruining of his life by government "experts" who knew no more about the matter than the man in the moon?—*Salt Lake Mining Review.*

The Tech of Boston tells of an individual heating apparatus for soldiers which Colonel Robert L. Howze is now testing to determine its practicability. The heater is not larger than a canteen and it is claimed that it will keep hot for 36 hours and can then be recharged for another period. The heater is filled with a chemical fluid which is first heated by immersion in boiling water. The chemical action increases the heat to a high degree and maintains it for 36 hours. A new charge is a chemical substance no larger than a pea. The "stove" and fuel may thus be carried by a soldier in his haversack.

The Oakland industrial appliance department of the Pacific Gas & Electric Company has made some demonstrations in cutting iron with fuel gas and oxygen. A special torch is used whereby a hot flame cuts its way through the iron. A plate of iron 30 in. wide and an inch thick was cut in two in two minutes and fifty-five seconds, using 3.25 cu. ft. of fuel gas and 6 cu. ft. of oxygen. Acetylene was used, taking 3 lb. and 6.5 cu. ft. of oxygen to do the same work. Fuel gas makes a saving of about 50 cents per day in a large shop doing continuous cutting.

At a recent joint meeting of representatives of the Institute of Bankers, the Association of Chambers of Commerce, and the Decimal Association, unanimous agreement was reached on a plan for decimalising the coinage with the present pound sterling as the unit. The scheme was brought before the council of the Association of Chambers of Commerce this week, and unanimously approved, a further resolution being carried to press the need for this reform, through the Chambers of Commerce in all parts of the United Kingdom.

For the eighth time since 1844 fish have been killed along the west coast of Florida in an area of poisoned water. Not only the water, but the air has been charged with a suffocating gas, odorless but irritating to the air-passages. The last mortality was reported in October and November of 1916. The Bureau of Fisheries sent experts to the spot but they were obliged to admit, after a careful investigation, that the cause of the strange occurrence is a mystery.

Before the war, if an aeroplane was provided with one horse-power for every 28 lb. of weight, it was considered capable enough for use over the battle lines. Now the fast scouting machines may have this amount of power for every 8 lb. or 10 lb. of weight, and even less.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

W. L. SAUNDERS, - - - Editor
FRANK RICHARDS, - Managing Editor
CHAS. A. HIRSCHBERG, - Business Manager
W. C. LAROS, - - Circulation Manager

PUBLISHED MONTHLY BY THE

Compressed Air Magazine Company
Easton, Pa.

New York Office—11 Broadway.
London Office—165 Queen Victoria Street.

Subscription, including postage, United States and Mexico, $1.00 a year. Canada and abroad, $1.50 a year. Single copies, 10 cents. Those who fail to receive papers promptly will please notify us at once.
Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

Entered as second-class matter at the Easton, Pa., Post Office.

Vol. XXIII. FEBRUARY, 1918. No. 2

CONTENTS

ELECTRICITY AND COMPRESSED AIR AS COAL SAVERS

In these days, when the thought of the general public is compulsorily directed to the saving of fuel, it is quite pertinent to call attention to the agencies which are both potentially and actively most efficient for the purpose. It may cause some surprise to the thoughtless that any claim should be made for the electric industries as commendable economists, but the fact that they use large quantities of fuel does not necessarily imply that the fuel is used wastefully. In fact the fuel operated plants of the large electric companies are monitors to the world of the ultimate, up to date possibilities in economical operation, the economies permeating every detail, the combustion of the fuel, the generation of the steam, its distribution and employment in the development of motive power, and then the consistent economies in the generation and distribution of the electric current. In the profuse and reckless use of electric light there may be undoubtedly great waste, which very properly should be stopped, at least under the present exigencies, but that is another matter.

But the surprising thing is that of the enormous employment of the electric current for every purpose, for light, heat and power, by far the larger portion of it is accomplished without the consumption of fuel at all. It is reliably stated that of the 650,000,000 tons of coal which will be mined this year in the United States only 4 per cent. represents the entire electric central station requirements of the country, the greater part of the electrical energy now used being generated in hydroelectric stations. In a general way every one knows this. The central station which employs water power for the generation of electric current is not to be regarded as a mere saver of fuel, but rather as an actual and most important contributor to the coal pile of the nation, and every available water power, whether at present utilized or not, is the equivalent of a coal mine, with the unique feature added that the mine cannot be exhausted.

In the wide employment of the electric current for power purposes, whether it be generated in the economically steam operated central stations of some of the larger cities, or in the more numerous and the more universally distributed water power utilizations, compressed air is an important cooperator. It is

to be said generally of the use of compressed air that where it is not indeed the only mechanical agency which can be successfully employed for the specific purpose, it is still in almost every case a time or labor saver and therefore intrinsically economical, and where the compressor is electrically driven there is a largely increased effect as compared with the power cost. The fuel saving idea, which has been brought to the front by the exigencies of the war, has really nothing of novelty about it. The larger engineering contractors, in their quest of the larger profits, have made a systematic study of it, and accordingly we find the electric driven air compressor in use wherever the modern enterprises are successfully conducted. We are not at present in position to submit actual data, but the number of electric driven compressors is quite astonishing and rapidly increasing.

IMPORTANT WORK OF THE NAVAL CONSULTING BOARD

The Annual Report of the Secretary of the Navy for the year, 1917, speaks in terms of high appreciation of "the able and helpful Naval Consulting Board."

"The Naval Consulting Board," it says, "has been found very useful, not only in assisting in the solution of military problems but in dealing with the immense flood of inventions and ideas submitted to the department from the country at large. It is true that a majority of these are not found to be of practical value, but it is a fact that practically all of them are submitted with the patriotic motive of helping win the war, and the department has felt that they are all entitled to serious and appreciative consideration."

The following is the complete text of the report upon this topic:

THE NAVAL CONSULTING BOARD.

During the year the work of this board, organized and approved by Congress in 1915, has increased very materially in importance and volume, its meetings have been frequent and the work of its individual members has been such in some cases as to occupy almost their entire time in the service of the Government.

Some time before the active entry of this country into war the board called a special meeting to which were invited some fifty of the leading scientists and industrial managers, whose special study fitted them to advise on the methods of meeting the submarine problem. Plans were immediately made to investigate every field to develop a means of preventing destruction of vessels and of defeating the U-boat. The investigation was divided according to the experience of the different members and associated scientists, and, with the cooperation and valuable assistance of the various manufacturing companies interested, a highly developed system of team-work has been attained and results accomplished not dreamed of at the beginning of the war.

The services of the board were offered to the Council of National Defense and accepted by that body for the investigation of all inventions submitted. Its services were also accepted by the War Department in an advisory capacity.

Valuable assistance has been rendered merchant shipping by the board's activities. Through its initiative, counsel and work, the United States Shipping Board formed its ship-protection committee, taking over the study of the protection of merchant ships, and to this committee was detailed one of the Consulting Board's most experienced members qualified in shipbuilding and with sea experience. In this field the board's work has resulted in materially reducing the shipping risk, with a consequent lowering of marine insurance rates.

Not the least result of its work has been the stimulation of interest, in the problems brought up by the war, throughout the country by the general invitation to submit ideas for investigation. Early in the calendar year 1917 this interest manifested itself in the receipt of thousands of ideas weekly, and to care for this the department's connecting office has been greatly enlarged, the office of the board in New York has been organized on a working basis with a large force, and the whole movement has received the approval and hearty assistance of the great national engineering societies. The president of the board, Mr. Thomas A. Edison, has been giving his entire time to the work of the board in the service of his country, and has called to his assistance a capable staff who are working diligently upon naval problems.

With war conditions increasing the need for labor and building materials, it was believed to be a wise policy to defer for a time the building of the new experimental and research laboratory. Such experiments as have been

warranted have been made in private laboratories, generously offered, and at the Bureau of Standards. The need for this establishment, however, is more clearly shown than ever, and its support is urgently advised.

The valuable results obtained by the work of this board are of too confidential a nature to make them the subject of a public document. The members have given freely of their time and scientific ability to the service of the Nation and have earned the gratitude of all who know their unselfish and patriotic service. I wish to express my sense of obligation for the cheerful cooperation, wise counsel, loyal devotion, and personal sacrifice which have characterized the membership of the board of distinguished civilians who responded, long before war was declared, to the selective draft with all the enthusiasm and efficiency of youthful volunteers.

MOUNTING HAMMER DRILLS ON TRIPODS

The following letter to the Editor of *Engineering and Contracting*, with the appended editorial comment, will be found interesting and is sufficiently self-explanatory. It does not seem to be necessary to reproduce the original article here referred to.

To the Editor: In your issue of Nov. 21, page 409, I note an editorial entitled, "Why Are Air Hammer Drills Not Mounted More Commonly on Tripods?"

The suggestions contained in this editorial seem to me to be rather dangerous and are very apt to invite trouble. The modern hammer drill used for down hole work, unlike the reciprocating drill, is of very light construction, weighing not to exceed 40 lb. to 60 lb. A suitable tripod would weigh in the neighborhood of 150 lb. to 200 lb. or from three to four times as much as the drilling machine. The drill used without a tripod requires no helper, whereas mounted on a tripod a helper would have to be provided in order to handle the heavy mounting. There is no real excuse for mounting a 40-lb. machine, as most of them are self-rotating, and the only effort required on the part of the operator is in holding the machine to its work when starting a hole and in changing drill steels, which work would not be eliminated by the use of a tripod. This is irrespective of the depth of the hole.

You refer particularly to the application of a tripod and hammer drill to work in seamy ground. It seems to me the objections to the use of this type of equipment are even more pronounced than under other conditions, as the drilling machine would necessarily be in fixed position, and the tendency of the drill bit to follow a cleavage would put an enormous strain on a comparatively light drilling machine. I am afraid this would lead to all sorts of trouble.

There is another objection to a tripod mounting, and that is the time lost in moving the mounting and readjusting the machine from hole to hole would materially reduce the actual drilling time, materially increasing the cost of drilling per foot of hole. It is not uncommon to find an unmounted hammer drill will put down a reasonable depth hole in the time ordinarily required to move a tripod and reciprocating rock drill.

C. A. Hirschberg,
Publicity Manager, Ingersoll-Rand Co.,
New York.

[The editorial suggestion in our issue of Nov. 21 was prompted by the fact that 40-lb. hammer drills are being successfully used on quarry bars and tripods in two quarries of the Knoxville, Tenn., marble district. The Appalachian Marble Co., for example, has displaced 6 piston drills with 4 air hammer drills (40-lb.), and only 5 men are needed to operate the 4 hammer drills as against 12 men formerly required on the 6 piston drills. Hammer drills are mounted in pairs on a quarry bar 10 ft. long. Drill holes are 14 ft. deep and 1½ in. diameter at the top 1 1/16 in. at the bottom. The holes are close spaced, which enables the drilling of several holes from one setting of the quarry bar.—*Editor Engineering and Contracting.*

NEW BOOKS

The Modern Gasoline Automobile, its Design, Construction, Operation and Maintenance. By Victor W. Page, M. E., New York. The Norman W. Henley Publishing Company, 1032 pages, 5½ by 8½ in. Nearly 1000 illustrations, 13 folding plates, $3.00, net.

This is a seventh edition of a successful standard work, but is much more than this statement would usually imply. The entire

work has been thoroughly revised and corrected and much supplementary matter has been added. Many entirely new topics have come up and have received adequate treatment so that the work is entirely up to date. The book in previous editions has been adopted as a text book in various institutions, for which service it is now better adapted than ever, while it appeals also to the great public now so intimately in touch with the supreme modern means of locomotion.

AVIATION ENGINES, Design, Construction, Operation and Repair. By First Lieut. Victor W. Page, New York. The Norman W. Henley Publishing Company, 589 pages, 5½ by 8½ in., 253 cuts, copiously indexed. $3.00, net.

The airplane is now recognized as supreme among the active agencies which are to determine the result of the World-War, and the engine is the heart of it, so that no book could have appeared more opportunely, especially as it is the work of a man of special and extended and up-to-date experience in this line. The matter of the book covers the topic completely and is arranged in logical sequence. The descriptive matter is clear and satisfying and the cuts are pertinent and helpful.

This book has been censored by the U. S. Government and a few pages and portions of pages are necessarily printed blank.

A BOOK NOTICE WORTH PASSING ALONG

The editor of *The Little Journal* casts aside all conventions and confesses to an ambition —to put it in Japanese fashion,—to pull the honorable and august legs of its readers. He has written a book called *Everyman's Chemistry* which is published by Harper & Brothers, New York, for which they charge two dollars. He admits also that he thinks the price rather high. It is a real chemistry book, beginning with general chemistry and proceeding through the general, inorganic and organic fields, but he tried to be good-natured over it. It is aimed at the man who has not studied the science but who sometimes wishes that he knew something of it.—*The Little Journal, Boston.*

DEVELOPMENT OF THE AIR HOIST*

Compressed-air hoists, which are now so extensively used in machine shops, foundries, boiler shops, locomotive shops, railroad repair shops, and in fact, wherever it is necessary to lift any considerable load, were devised in the shops of the Chicago Bridge and Iron Works, South Chicago, in about 1891.

In constructing the hoist a piece of cast-iron pipe was utilized. This was threaded on each end, and caps or heads were affixed: the one at the lower end having a stuffing box through which passed a rod connected to a piston, and designed to be connected by a chain to the object to be raised; while the head on the upper end was provided with means for its attachment to a wheel adapted to move on a track. The air hose was connected to a three-way cock located at the bottom of the cylinder, thus permitting air to be admitted to and exhausted from the latter, or its supply thereto entirely cut off.

A large number of these hoists in varying sizes were used and found to be of great benefit in lifting, and carrying loads to different points. However the workmanship was crude and the escape of air prevented the load from being held for any considerable length of time in its suspended position. Further than this, the piston was permitted unimpeded upward movement, and in consequence, when a light load was being raised and the air turned on too suddenly, the piston would strike and break the upper head. The Chicago Bridge and Iron Works, made no attempt to market this device, but did manufacture a considerable number on special order for those who had seen the hoist in operation.

One of the first concerns to adopt the hoist was the Ames Iron Works, Oswego, N. Y. This was in 1892. The initial introduction was that of a single hoist in their machine shop, and it proved so convenient and valuable as a time and labor-saver, their shops were soon fully equipped. Hoists were later installed in the boiler shop.

The attention of the Pedrick & Ayer Co., Philadelphia, builders of machine tools, being directed to the compressed-air hoist, and they appreciating its merit and the possibility of an

*Special correspondence *American Machinist.*

extensive sale, began the refinement and manufacture of the hoist on a commercial scale. The cylinders of the hoists for those of the light class were of seamless brass tubing with the bore accurately machined to prevent air leakage. The larger sizes were of the cast-iron pipe construction employed by the Chicago Bridge and Iron Works; but in both instances the workmanship was that of a high-grade machine shop. The Pedrick & Ayer Co. also designed and manufactured belted air compressors, and thus were in a position to supply a complete hoisting outfit. Their connection with machinery dealers and with the railroads was wide, and the pneumatic hoist was quickly taken up by those to whom it was presented. The business of the Pedrick & Ayer Co. was soon discontinued owing to financial difficulties, and the hoist branch taken over by the Q. & C. Co., of Chicago. By it, the hoist was in no way featured, and was sold only as an adjunct to a number of specialties principally used by the railroads.

The first concern to direct its efforts seriously to the perfection of the compressed-air hoist, and to go into the matter in a whole-hearted manner was the Curtis & Co., Mfg. Co., St. Louis, who started the manufacture of hoists in 1893. They established a separate branch in their manufacturing establishment devoted solely to the development, improvement, and manufacture of the hoist, and made rapid strides in its introduction.

The single-acting hoist heretofore described as being crude, is still manufactured, but it is only put to the simplest of uses; for in addition to the liability of fracture of the top head it has the further fault of requiring external force to lower the piston rod after the load has been released.

POSITIVE CONTROL

Where positive control is required, the balanced pressure hoist is by far preferable to the simple hoist. In this construction of hoist, the under or lifting surface of the piston is at all times subject to air pressure, and the upper surface subject to full or no air pressure, as may be desired. As the area of the piston rod passing through the stuffing box makes the effective area of the two sides of the piston unequal, the tendency is to force the latter to the lower end of the cylinder by a force proportionate to the area of the piston rod; therefore on air being exhausted from the upper end of the cylinder, the piston rod with its load is caused to rise with a speed depending on the rapidity with which the air is withdrawn from the upper end of the cylinder. The speed regulation in a hoist of this description is particularly refined, and it is surprising how accurately the load can be raised to almost the slighetst fraction of an inch, making it particularly adaptable for machine-shop use. A load can be sustained for as long a period as thirty minutes without any appreciable drop.

As the quick and economical handling of materials is of vital importance, lifting is now generally performed by the compressed-air hoist instead of by hand. Floor space otherwise congested is kept clear for new work. The time of passing a job from one stage to another is reduced, and a general all-around saving effected.

THE SENTRIES POSTED IN THE SKY

Hardly a train moves within five miles back of the German trenches, or a squadron of men come up for relief, or digging begins on a new series of emplacements but a pair of keen eyes, steadily watching from great observation balloons just behind the Allied front take notice of it. Every movement, every activity, is registered until a schedule of the usual enemy routine is built up and the average amount of motion known. Any departure from this schedule is suspicious. A train running late or with more cars than usual, men in the trenches being relieved too frequently, new roads or emplacements being built too earnestly, give the first hint that "Fritz," across the line, is up to something. A keen balloonist notes any of these changes and at once telephones down to the ground, "An extra train of six cars passed ——— at 10.40." Half a mile farther down the line another pair of eyes reports, "Large convoy moving up to front, range so-and-so." Still a little farther down another suspicious circumstance is noted, until the general staff down below, assembling all these straws, foresees the beginning of a big offensive across the line. Counter measures are taken, batteries directed, convoys and trenches are smashed up, and the enemy's plans thrown askew.

NOTES

Following an investigation of the mine explosion of mine No. 1 of the Yukon Pocahontas Coal Company at Yukon, W. Va., Earl Henry, chief of the State Department of mines, declared that an air short circuit was the cause of the explosion. While repair work was going on a door on the main intake airway was left open. The short circuiting allowed gas to accumulate in other parts of the mine.

Think of coal mines having to shut down for lack of coal! Scores of mines in Central Pennsylvania operate with electric current furnished by the Penn. Central Light and Power Company, and the company officials say that the plant will shut down if coal cannot be procured.

Officials of the Westinghouse Lamp Company of Bloomfield, N. J., have appealed to Federal food authorities for 35 pounds weekly of brown sugar, stating it would be necessary to suspend operations in the company's plant unless the request was granted. It was explained that brown sugar is used in infinitesimal amounts in the manufacture of electric globes.

The Paris *Journal* recently published an admonition to the public to burn gas where it could with the following conclusions, which, however, the American reader must analyze and apply for comparison to his own local conditions: "To burn gas will be to economize our coal production. A thousand kilos of coal distilled in a gas retort equals more than 1,200 kilos burned in a domestic stove, besides which it has produced 500 kilos of coke, 7.1 kilos of benzol, 9 kilos of sulphate of ammoniaque, 10 kilos of heavy oils or carbure, 1 kilo of phenol."

In one recent battle 250,000 18-lb. shells were fired. This means that 2,250 tons of metal were shot through the air in a single engagement. It would take one man 416 years, working 10 hours a day, to make these shells, or 250 men would have to work 20 months on the same task.

The sinking of a concrete cofferdam for the Louisville Gas & Electric Co. was greatly facilitated by enclosing the exterior of the cofferdam with perforated horizontal pipes spaced 6 ft. apart vertically. Water under pressure was delivered to these pipes, and lubricated the surface of the caisson sufficiently to greatly reduce the skin friction.

Dynamite cartridges encased in tin tubes were used successfully in blasting a water supply channel in quicksand at one of the plants of the American Brick Co. The channel is 530 ft. long and extends through a tangle of underbrush. The soil is quicksand and clay. In blasting through the clay, a hole was bored and cartridges pushed down with a stick no tamping being necessary as the water filled the hole.

The atmometer is a porous clay cup filled with water and used for determining the rate of evaporation due to drying power of air. The humidity of the surrounding air is determined by the rate of evaporation of the water, usually for a period of twenty-four hours. The evaporation rate is expressed as cubic centimeters of water evaporated per standard atmometer per hour. The device is used in testing ventilation in buildings, schools, etc.

Some tests were carried out in the Laboratory of the University of California on the water-tightness of plaster "shot" on the dam face with a cement gun. Several plaster slabs, from ⅜ to 1½ in. thick, made at Gem Lake, were tested with water pressures ranging from 700 to 1,600 ft. for several hours, with no moisture coming through the slab. One 1-in. slab held a head of 1,610 ft. for 2½ hours without showing moisture, then the water pressure was raised gradually to 3,400 ft., and the specimen broke in bending, having leaked a little just before breaking.

There is a stretch of railway along the west coast of Ireland where it was formerly not an uncommon occurrance for the trains to be blown from the rails by the winds from the ocean. These disasters are now prevented by the use of an ingenious form of anemometer which rings an alarm bell when the velocity of the wind reaches sixty-five miles an hour. Each station on the line keeps on hand a stock of movable ballast, a ton of which is placed aboard every car arriving at the station after the bell sounds.

Careful attention is being called to powdered coal as an excellent form in which to use lignites or low grade coal generally. Experiments made by the General Electric Company show that coal can be pulverized more cheaply than it can be gasified. The first cost of a plant for drying and pulverizing is less than for a producer gas plant. When thoroughly mixed with a blast of air in correct proportions powdered coal is practically a gaseous fuel, and has most of the advantages of gas or oil fuel under steam boilers.

A new rust-prevention process recommended for small machine parts is an application to the surface of the iron or steel of iron phosphates. After thorough cleaning, the articles are immersed in a bath containing ferric and ferrous phosphates, with a little manganese dioxide, and at boiling-water temperature they are left until hydrogen is no longer given off. The articles are then air-dried, when they may be treated with mineral oil, or painted, japanned, or otherwise finished. As the phosphate surface is attached chemically to the metal, no rust forms even in cracks in the paint.

From measurements of the wind velocity at five different heights up to 258 meters above the ground at the German wireless telegraph station at Nauen, the law is deduced that wind velocities at different heights vary as the fifth roots of the heights. At 512m. the velocity is twice that at 16m. The diurnal variation of wind velocity at the surface with a maximum in the afternoon extends in winter only to a height of about 60 m. above the ground. Above that height the opposite type of variation is found, with a maximum in the night. The neutral zone between the two types is considerably higher in the summer, probably at about 300 m.

A most obtrusive object in any view of the city of Rio de Janeiro is the elevation known as Costello Hill. Notwithstanding the strikingly picturesque effect, the presence of the hill is highly objectionable, since it cuts off the cooling winds from the city. For a hundred years or more it has been proposed that this obstruction be removed, and now a syndicate has been formed which has applied to the Government for permission to level the hill, using the material removed to reclaim a large area of submerged land. The work will involve the removal of 47,000,000 cubic yards and it is estimated that the cost will be $10,000,000.

One of the greatest conservation factors in the dairy industry is found in the manufacture of powdered milk by processes which began to come into wide use about 15 years ago. The last available census figures for 1914 gives the total production of powdered milk as 20,000,000 pounds a year in the United States, of which New York State made almost half, with Wisconsin second and Michigan third. Nine pounds of milk powder represent 100 pounds of milk, and all forms of milk, such as whole milk, skim milk, buttermilk, and cream, are now dried successfully, as well as modified milk for infants' food. Dried milk products are in such demand that this country has never had a surplus for export.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

DECEMBER 4

1,248,467. AUTOMATIC PUMPING SYSTEM. Earl E. Eby, Wilkinsburg, Pa.

1,248,481. FLUID-OPERATED DRILL. Louis W. Greve, Cleveland, Ohio.

1,248,487. APPARATUS FOR REDUCING RESPIRATION. William Harrison, Detroit, Mich.

1,248,507. POP-GUN. Charles F. LeFever, Plymouth, Mich.

1,248,631. AIR PURIFIER AND HUMIDIFIER. Malcolm Dickerson, Newark, N. J.

1,248,657. CARRIER - DESPATCH POWER-CONTROL SYSTEM. Charles P. Hidden, Brookline, Mass.

1,248,658. SINGLE-TUBE PNEUMATIC-DESPATCH SYSTEM. Charles P. Hidden, Brookline, Mass.

1,248,664. GLASS-BLOWING MACHINE. August Kadow, Toledo, Ohio.

1,248,689. METHOD OF SHOOTING OIL-WELLS. James E. McAvoy, Foxburg, Pa.

1. The herein described method of shooting oil wells which consists in closing the lower end of the well hole against pressure and supplying compressed gas to the well below the tube, and then exploding a charge in the body of compressed gas.

1,248,740. UNLOADING DEVICE FOR AIR-COMPRESSORS. Wade H. Wineman, Chicago, Ill.

1,248,767. PNEUMATIC - DESPATCH - TUBE APPARATUS. Frederick Gage Whittier, Ipswich, Mass.

1,248,851. DISTRIBUTING POWDERED MATERIAL. Charles L. Heisler, Schenectady, N. Y.

1,248,861. PNEUMATIC LIFTING-JACK. John H. Holloway, La Fayette, Ind.

1,248,950. VACUUM GASOLENE - RENOVATOR. John J. Tokheim, Cedar Rapids, Iowa.

1,248,966. VALVE FOR PERCUSSIVE TOOLS. Russell H. Wilhelm, Easton, Pa.

1,248,972. PULP-FEED REGULATOR. Isaac J. Witham and George E. Mayo, Cheboygan, Mich.

1. In a pulp feed receptacle, an air container within said receptacle connected with a source of supply, the pressure in said container being controlled by the density of the pulp in said receptacle, and a gage connected with said container for recording the density of the pulp through the instrumentality of the air pressure in said container.

1,248,990. SMOKE - PREVENTER. Ransom Bailey, Milwaukee, Wis.

1,249,042. PNEUMATIC SHEET - SEPARATING MACHINE. Talbot C. Dexter and Ross Meredith, Pearl River, N. Y.

1,249,565. LIQUID-DISPENSER. William F. Wagner, Ambridge, Pa.

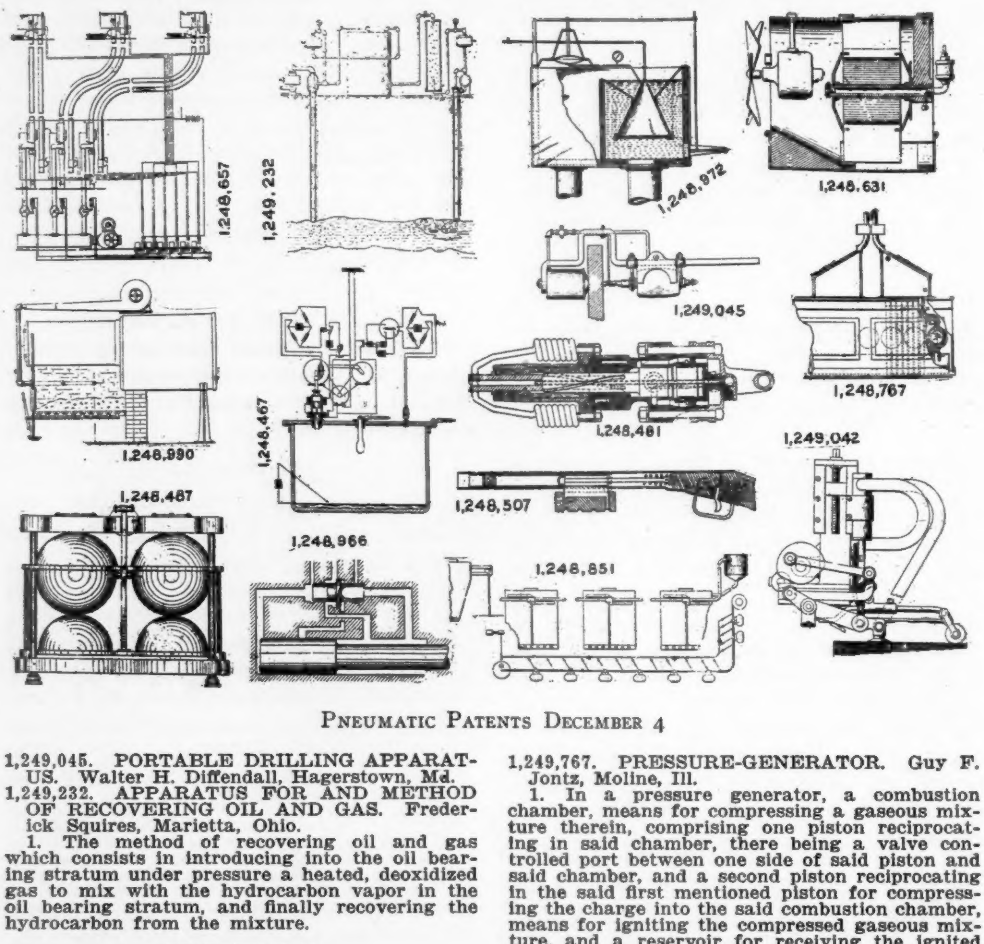
1,249,581. ENGINE-PRIMER. Raymond O. Wones, Maplewood, Ohio.

1,249,596. FLUID-PRESSURE REGULATOR. Arthur W. Cash, Decatur, Ill.

1,249,601. FLUID CONTROLLING AND METERING DEVICE. Sebastian Ziani de Ferranti, Grindleford Bridge, near Sheffield, England.

1,249,625. COMBINED BLOW-TORCH AND SOLDERING-IRON. Walter J. Herzog, Pekin, Ill.

1,249,692. EXHAUST-FAN FOR VACUUM-CLEANERS. William H. Upton and Oscar Stolp, New York, N. Y.



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1,249,045. PORTABLE DRILLING APPARATUS. Walter H. Diffendall, Hagerstown, Md.

1,249,232. APPARATUS FOR AND METHOD OF RECOVERING OIL AND GAS. Frederick Squires, Marietta, Ohio.

1. The method of recovering oil and gas which consists in introducing into the oil bearing stratum under pressure a heated, deoxidized gas to mix with the hydrocarbon vapor in the oil bearing stratum, and finally recovering the hydrocarbon from the mixture.

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1,249,382. DEVICE FOR AND METHOD OF MIXING GAS AND AIR FOR CONBUSTION. Stephen Hugh Hale, Kansas City, Mo.

1,249,392. PROCESS AND APPARATUS FOR OXIDIZING GASES. Ingenuin Hechenbleikner, Charlotte, N. C.

1,249,438. PNEUMATIC WHEEL. William Henry McCaffrey, Birmingham, Ala.

1,249,484. METER. George D. Pogue, St. Louis, Mo.

1,249,558. FLUID-PRESSURE BRAKE. Walter V. Turner, Edgewood, Pa.

1,249,767. PRESSURE-GENERATOR. Guy F. Jontz, Moline, Ill.

1. In a pressure generator, a combustion chamber, means for compressing a gaseous mixture therein, comprising one piston reciprocating in said chamber, there being a valve controlled port between one side of said piston and said chamber, and a second piston reciprocating in the said first mentioned piston for compressing the charge into the said combustion chamber, means for igniting the compressed gaseous mixture, and a reservoir for receiving the ignited mixture, communicating with said combustion chamber.

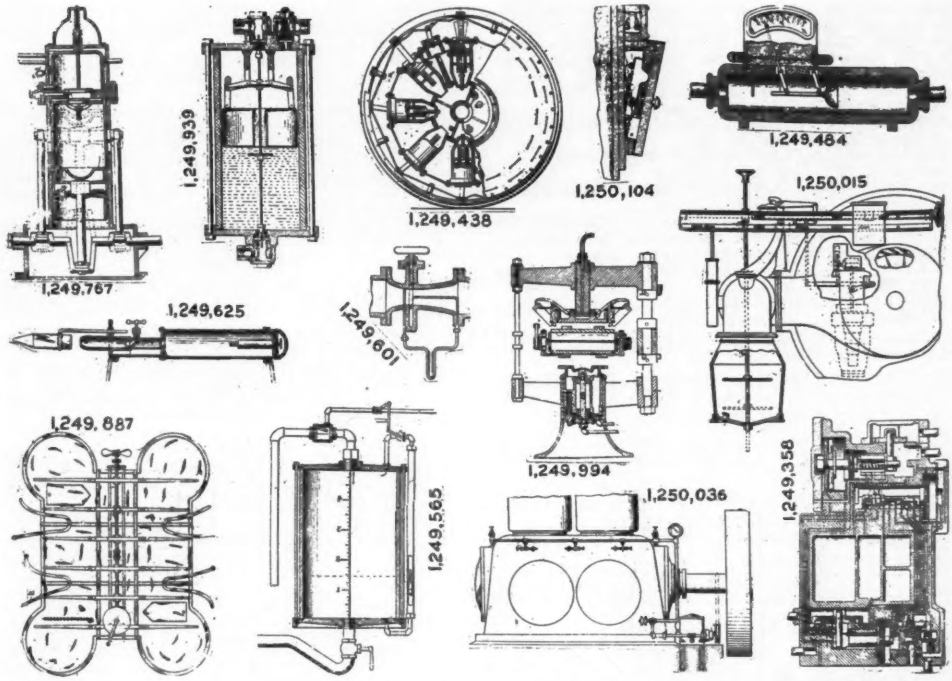
1,249,777. PNEUMATIC PIANO-ACTUATING VALVE. Walter A. Kruck, Camden, N. J.

1,249,822. ICE - MACHINE COMPRESSOR. Henry D. Pownall, Canton, Ohio.

1,249,887. LIFE-SAVING RAFT. John Benyak, Glassport, Pa.

1,249,921. HYDRAULIC AIR-COMPRESSER. Kennedy Dougan, Minneapolis, Minn.

1. A hydraulic air compressor comprising a cylinder in which the air is compressed by a moving column of water, means having intermittent communication with said cylinder for



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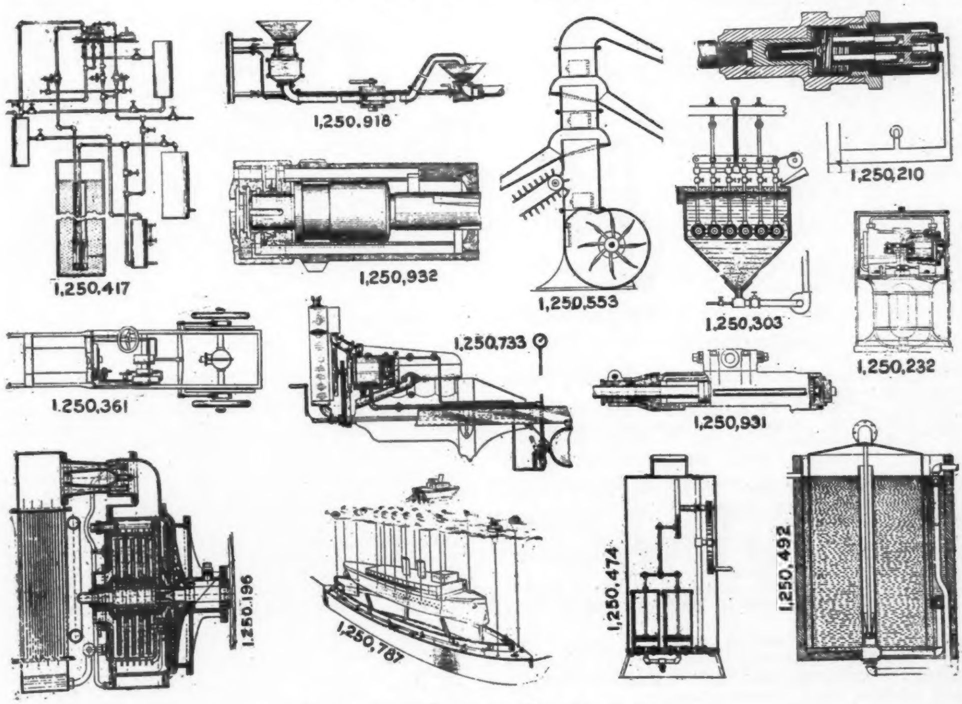

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admitting and directing the water suddenly into the same, said means operating thereafter to open the cylinder and permit the escape only of that part of the column of water which had entered the said cylinder.

1,249,939. VACUUM FUEL-FEED SYSTEM. Wray Falwell, Fitchburg, Mass.

1,249,994. MOLDING-MACHINE. William H. Nicholls, Brooklyn, N. Y.

1,250,005. CENTRIFUGAL COMPRESSOR. Edmund M. Phillips, Lynn, Mass.

1,250,015. CONSTANT-VOLUME GOVERNOR. Richard H. Rice, Lynn, Mass.

1,250,029. CENTRIFUGAL COMPRESSOR. Christopher A. Schellens, Marblehead, and George W. Pentheny, Lynn, Mass.

1,250,036. OILING APPARATUS. Thomas Shipley, York, Pa.

1,250,078. COMPRESSED-AIR TANK. Martin B. Barkman, Hillsboro, Kans.

1,250,104. PNEUMATIC REGULATOR. Adolph P. Gustafson, Chicago, Ill.

1,250,111. EXCESS - BRAKE - CYLINDER-PRESSURE-CONTROL MECHANISM. Willis C. Webster, Dubois, Pa.

1,250,553. APPARATUS FOR SORTING HETEROGENEOUS MATERIALS. Daniel R. Bryan, Chatham, N. J.

1,250,733. PNEUMATIC STARTING MECHANISM FOR AUTOMOBILES. Clinton L. Walker, Piedmont, Cal.

1,250,787. MEANS FOR RAISING SUNKEN VESSELS. Gedeon Breault, Pawtucket, R. I.

1,250,918. METHOD OF AND APPARATUS FOR MIXING AND DELIVERING CONCRETE. John H. MacMichael, Toledo, Ohio.

1,250,931. ROCK DRILL. George H. Gilman, Claremont, N. H.

1,250,932. PRESSURE-FLUID MOTOR. George H. Gilman, Claremont, N. H.

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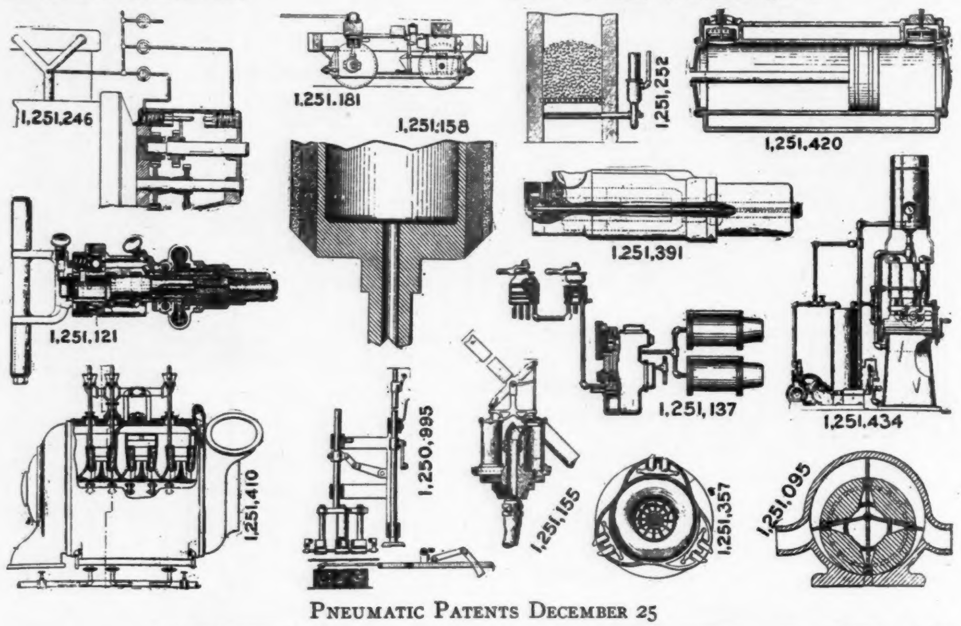
1,250,995. PATCH - APPLYING MECHANISM FOR WINDOW-ENVELOPS. Carl O. Ekvall, Brooklyn, N. Y.

1,251,095. FLUID-MOTOR. Mathias A. Patton, Idaho Falls, Idaho.

1,251,121. PNEUMATIC TOOL. Mather W. Sherwood, Franklin, Pa.

1,251,137. FLUID-PRESSURE BRAKE. Walter V. Turner, Wilkinsburg, Pa.



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1,250,196. GAS-TURBINE. Emile Louche, Boulogne-Sur-Mer, France.

1,250,210. FLUID - PRESSURE - CONTROLLED SWITCH. Harry Y. Norwood and Fred. K. Taylor, Rochester, N. Y.

1,250,232. PUMP. Paul Schou, Copenhagen, Denmark.

1,250,303. FLOTATION APPARATUS. William E. Greenwalt, Denver, Colo.

1,250,304. AIR-GUN. William B. Greenleaf and Ernest S. Roe, Plymouth, Mich.

1,250,361. AIR-BRAKE SYSTEM. Frederick E. Shallock, San Francisco, Cal.

1,250,417. COMBINED WATER AND PNEUMATIC PUMP. Jesse B. Barrett, Jamestown, N. Y.

1,250,474. AUTOMOBILE PUMP. Atha W. Lee, Bingham Canyon, Utah.

1,250,475. AUTOMATIC AIR SPRING. Richard Liebau, New Haven, Conn.

1,250,492. SUCTION-PRODUCING MACHINE. Theodore W. Nygreen, Bellingham, Wash.

1,251,155. FLUID-PUMP. Albert Wiltz, Addy, Wash.

1,251,158. FORM-ROLLER. Henry A. Wise Wood, New York, N. Y.

1,251,175. METHOD OF AND APPARATUS FOR STRIPPING RUBBER JARS FROM CORES. Harry L. Boyer, Trenton, N. J.

1,251,181. AIR-BRAKE SYSTEM FOR TRUCKS. Elbert G. Chandler, Portland, Oreg.

1,251,246. VACUUM GEAR-SHIFTING DEVICE. Raymond F. Landis, Reading, Pa.

1,251,252. STEAM AND AIR MIXER FOR GAS-GENERATORS. Ferdinand Logan, Phoenixville, Pa.

1,251,357. PNEUMATIC VEHICLE - WHEEL. Adolph W. Eckhardt, New York, N. Y.

1,251,391. ROCK-DRILL. William H. Leonard, Denver, Colo.

1,251,410. COOLING CENTRIFUGAL COMPRESSORS. Fred Elmer Norton, Worcester, Mass.

1,251,420. VALVE FOR AIR-COMPRESSORS. George M. Richards, Philadelphia, Pa.

1,251,434. DRILL-SHARPENER. William A. Smith, Denver, Colo.